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RAILWAY
MECHANICAL ENGINEER

Baltimore & Ohio

Glenwood Wheel Shop

Features of consolidated wheel shop include straight-line production layout, new tools and material-handling equipment

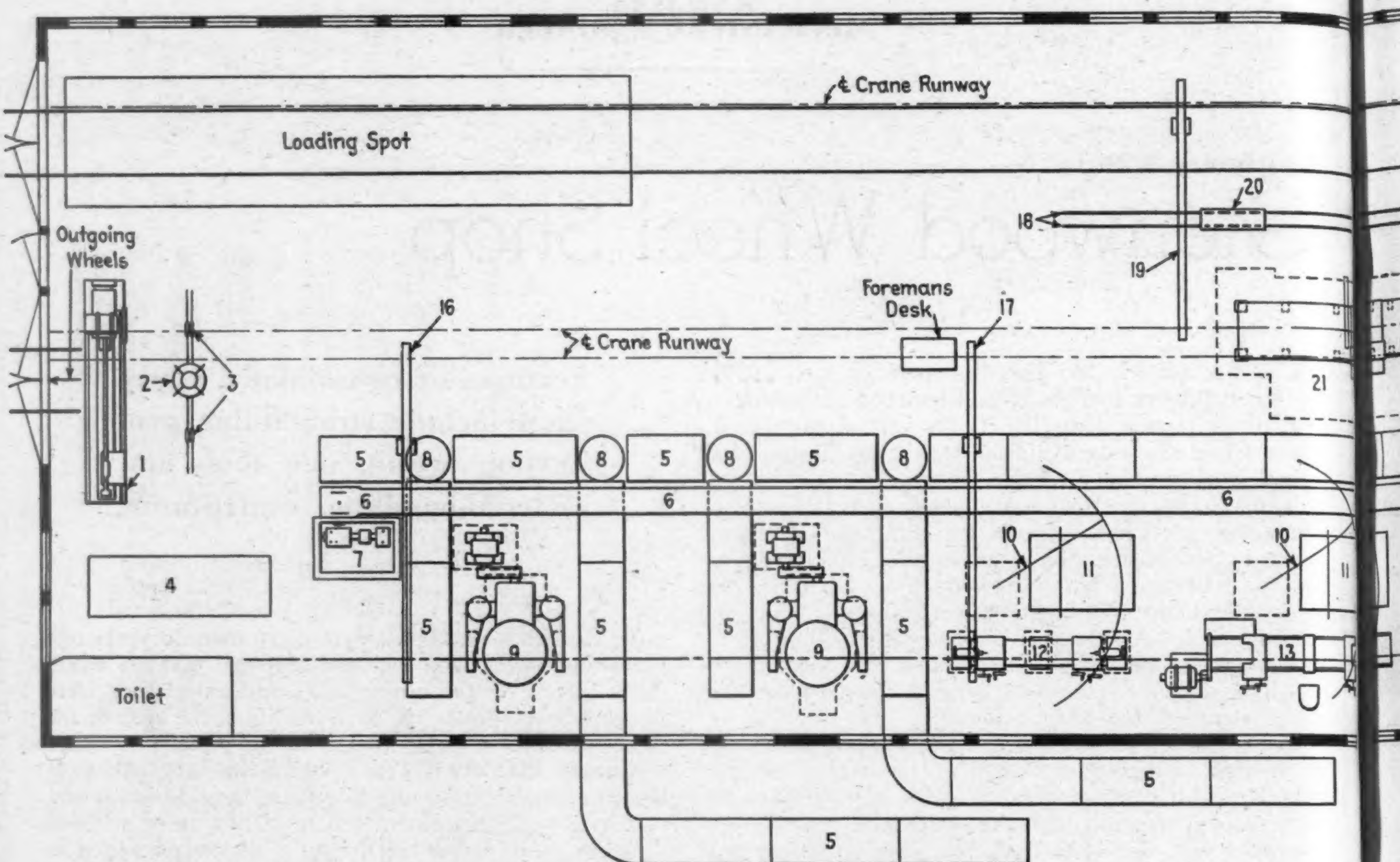
A NEW wheel shop was placed in operation early in 1946 by the Baltimore & Ohio at its Glenwood (Pittsburgh), Pa. repair point. This shop is the first of the consolidated wheel shops contemplated for the production of all wheel work on the B. & O. system.

Prior to the construction of the new shop at Glenwood there were ten wheel shops on the B. & O. These were located at Mt. Clare, Md.; Cumberland, Md.; Fairmont, W. Va.; Lorain, Ohio; Glenwood, Pa.; Du Bois, Pa.; Ivorydale, Ohio; Washington, Ind.; Newark, Ohio, and Clifton, S. I. A survey of the general condition of the machinery in the ten shops indicated that most of the machines should be renewed if a higher standard of wheel-shop operation was to be achieved.

All of the ten shops mounted and stripped wheels and some had equipment for turning the treads of steel wheels. Most of them had single-end converted engine lathes for truing journals and although a few were equipped with double-end gap-type lathes for this purpose, even these machines were more than 25 years old. Only one wheel shop had a double-end 600-ton wheel press. Some of the boring mills and axle lathes were of obsolete design and in poor condition, the ages of the older machines ranging from 27 to 48 years.

A study was made in 1944 covering the consolidation of the wheel work at several points, a move which would eliminate to a large extent the rehabilitation or renewal of the machines in the ten shops. This study resulted in

Interior of the Glenwood wheel shop looking toward the mounting end—The rack for the stripped axles awaiting recentering is in the right foreground—Note the roomy appearance of the shop and the material-handling facilities



No.	Machine or Equipment
1	Press, mounting, 400-ton wheel (proposed location)
2	Jack, axle
3	Dollies, wheel
4	Inspection equipment, axle, Magnaglo (to be installed)
5	Conveyor, roller (wheels)
6	Conveyor, pallet, Mathews (axles)
7	Motor, pallet conveyor
8	Turntable, roller conveyor
9	Mills, wheel-boring, Niles (with right- and left-hand cranes)
10	Crane, one-ton jib, with electric hoist
11	Rack, axle, three-tier
12	Lathe, burnishing, Niles
13	Lathe, axle, Putnam
14	Lathe, axle, Niles
15	Press, stripping, 600-ton, Chambersburg

Key to machine tools and shop equipment

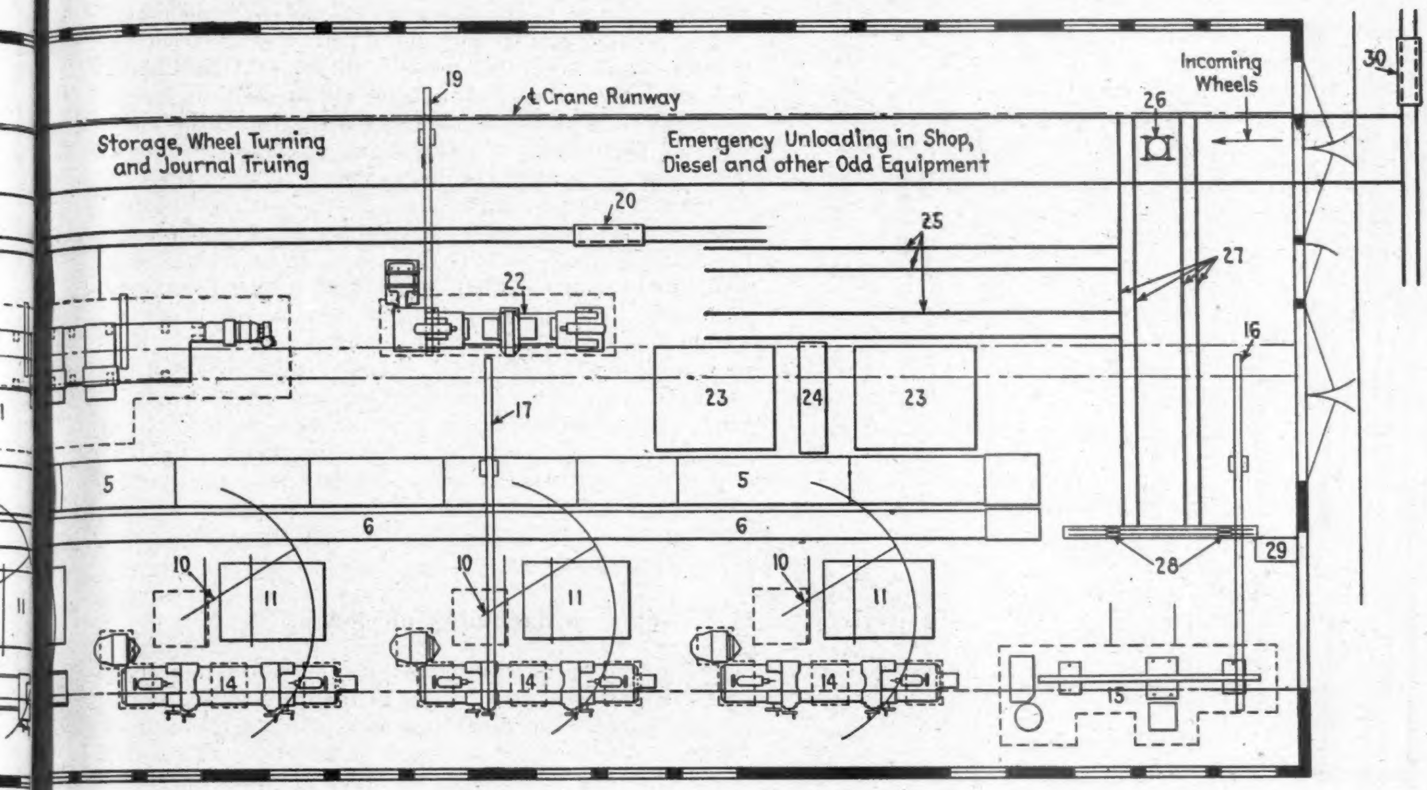
the selection of Glenwood for the location of the first consolidated shop because of its ideal location on the system and because a building was available at that point that could readily be adapted to the structural and track changes required for a centralized production shop.

Since its completion early in 1946 the Glenwood shop is furnishing wheels to stations previously supplied from the old wheel shops at Fairmont, W. Va.; Lorain, Ohio; Du Bois, Pa., Newark, Ohio, and Glenwood, with the result that the wheel operations at the first four shops have been discontinued with the exception of journal-truing work. The operation of the new wheel shop is producing savings of 2,630 man hours of labor per month, equivalent to $3,347, including shop expense, or yearly savings of $40,164. These savings are exclusive of those effected by the decreased cost of maintenance of the new machines as compared to the old machines used in the old shops. Since approximately $215,000 was expended on the project the cost will be amortized in five and one-third years.

The wheels are held in an upright position on the dollies after removal from the axle. One wheel is being rolled into the air-operated elevator which raises it to the wheel chute opening

General Features

The shop is designed as a straight-line production facility with old wheel pairs stripped at one end, finished pairs mounted at the other, and the intermediate operations completed in the proper sequence as the wheels and axles flow through the shop. Besides the new machine tools, a feature of the shop is the use of conveyors and hoists to reduce the moterial-handling time. It is equipped with six overhead cranes, two of 3-ton, two of 2-ton and two of 1-ton capacity, and five 1-ton jib



No.	Machine or Equipment
16	Crane, overhead, two-ton, Cleveland Trainrail, with electric hoist
17	Crane, overhead, one-ton, Cleveland Trainrail, with electric hoist
18	Track, dolly
19	Crane, overhead, three-ton, Cleveland Trainrail, with electric hoist
20	Dolly, wheel (mounted wheels)
21	Lathe, 50-in., Sellers
22	Lathe, journal-truing, Betts-Bridgeford

No.	Machine or Equipment
23	Rack, axle, four-tier
24	Machine, axle-centering
25	Tracks, storage, journal-truing
26	Jack, axle
27	Tracks, storage, wheel (to be stripped)
28	Dolly, wheel
29	Elevator, wheel (scrap and claim)

ment in the B. & O. Glenwood wheel shop

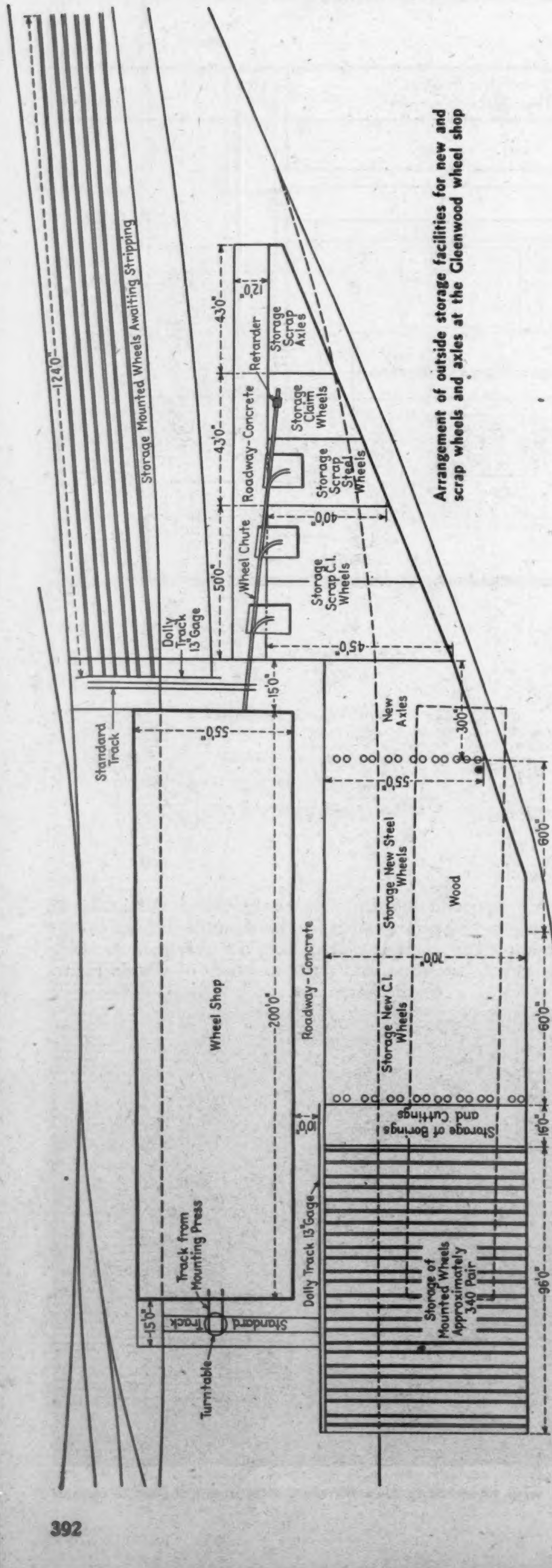
cranes, all with electric hoists. A 154-ft. motor-driven pallet conveyor is the principal means used for the movement of axles, and roller conveyors move the wheels from the cars outside the shop to the boring mills and from the machines to the mounting press.

An important factor in the production of the shop is the use of step sizes in turning the wheel-fit diameters at the axle lathes. The steps are in increments of $\frac{1}{32}$ in., the minimum diameter being the shop limit for each particular size of axle. The step sizes are numbered from 1 to 13 with size No. 1 being the minimum or shop limit, No. 9 the standard and Nos. 10 to 13 oversizes. The wheels are bored to match the axles, a line-up of the axles and size numbers being listed on a chart for the guidance of each boring-mill operator. This method of operation requires that only one nominal size of axle be handled durng each working day.

Sequence of Operations

The sequence of shop operations starts with the unloading of the wheel pairs from cars at the east end of the shop by the stores department. Using a 25-ton American Diesel-powered crane with a 60-ft. boom the wheels are placed on the storage tracks outside of the shop. They are unloaded by a particular size (5 in. by 9 in., 5½ in. by 10 in., etc.), the one selected being determined by the size scheduled for the day's operation. Each wheel pair is now moved on a dolly from the storage tracks to a door opposite the stripping press, but a change to be made in this arrangement is shown on the drawing of the shop. The change will reduce the work of handling wheels to the press and make a supply of wheels imme-

A scrap wheel rolling down the chute after leaving the wheel elevator



Arrangement of outside storage facilities for new and scrap wheels and axles at the Glenwood wheel shop

diately available to the operators of the stripping press.

The press operators pick up a pair of wheels with a two-ton overhead crane, move it to the 600-ton Chambersburg press where both wheels are pressed off simultaneously onto perforated collars placed around the journals for protection. Then the pair of wheels is rolled out of the press to wheel dollies that hold the wheels in an upright position during and after the removal of the axle. These dollies are mounted on a track underneath the flooring which permits the wheels to be moved to a spot next to an air-operated wheel elevator after the axle is removed. From the dollies the wheels are rolled one at a time into the elevator which lifts the wheels eight feet to an opening in the shop wall from where they roll by gravity down a chute to one of four bins. Air-operated gates, controlled by a valve near the elevator inside the shop, allow the stripping-press operators to select the bin into which each wheel goes. They are normally segregated by keeping all cast-iron, steel or claim wheels together in one or more bins depending upon the quantity of each class.

Machining of Axles

The axle from the dismounted pair of wheels is placed on a four-tier steel rack by one of the dismounting-press operators while the other operator is disposing of the wheels. As the rack is sloped slightly, the axle rolls toward the end adjacent to the axle-centering machine. At this station the axle is recentered, the wheel seats are calipered and numbered the step size of the wheel-seat diameter to which they can be machined. Recentering of the axles is done on a single-end centering machine but a new double-end machine is being developed for this shop which will recenter both ends of the axle simultaneously and also have the capacity to recenter mounted axles. From the centering machine the axles are moved to another rack in back of the centering machine. When needed, they are moved with a one-ton crane from this rack to the storage racks at each axle lathe, 24 axles being placed at each lathe before starting time.

The journals and wheel seats are turned on three Niles No. 3 double-end axle lathes with a center drive and an equalizing chuck and one Betts-Bridgeford lathe. The former are new machines while the latter was transferred from the Du Bois shop after it was rebuilt. The output is 14 to 15 axles per lathe in 8 hours using carbide cutting tools and a cutting speed of 85 r.p.m.

After the turning operations are completed the axle is moved on the 154-ft. Mathews pallet conveyor to the burnishing lathe, then to the Magnaflux station, and finally to the mounting press. The pallet conveyor is driven by an electric motor and controlled by push-button stations located at each lathe and at the mounting press, making a total of six control stations. An automatic cut-off switch prevents the axles from overrunning the end of the conveyor.

The burnishing lathe is a Niles double-end type equipped with opposed Stellite and high-speed burnishing rolls. It has a Neilson tailstock with Timken bearings and integral centers. Its output is 48 axles for an eight-hour shift. Burnishing can also be performed on the four axle lathes as they are furnished with opposed-type burnishing attachments.

Although the dry method of Magnaflux is now used to inspect the axles for defects, a Magnaglo machine is being developed for this shop which will improve the inspection operation. With this equipment the inspection medium is Magnaglo paste suspended in oil. It is used under a black light in a darkened location and cracks and flaws are readily seen in a fluorescent form.

Handling and Machining of Wheels

New wheels are unloaded from cars outside the shop and moved directly to the boring mills on roller conveyors. The conveyors outside the shop are portable and can be located to suit the cars from which the wheels are unloaded. The wheels are carried on the conveyors through openings in the shop wall directly to the right of the two boring mills where they are in a position to be lifted onto the mills as needed.

Wheel-boring facilities consist of two Niles hydraulic-feed mills arranged to utilize carbide tools. They are equipped with five-jaw chucks, table brakes, automatic feed attachments and hub-facing attachments operated by hydraulic feed and traverse. Davis No. 7½ special two-in-one boring bars with A and B cutters are used. Each boring mill has both a right- and a left-hand crane.

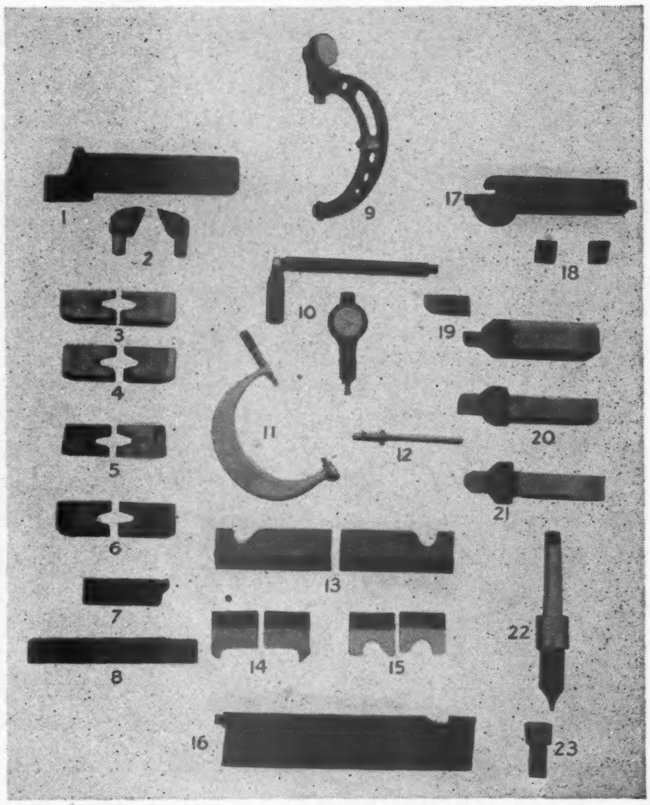
Using the right-hand cranes, the new wheels coming into the shop are lifted off of the roller conveyor bringing the wheels from the cars. Finished wheels are removed from the mills with the left-hand cranes and are placed on roller conveyors to the left of each machine which carries them down to the roller conveyor running longitudinally in the shop.

All wheels are bored to the chart sizes of axle dimensions which correspond to the step-size numbers previously assigned to the axles, with a proper tolerance being allowed to obtain the required mounting pressures. The roughing and finishing cuts are made in one operation, cast-iron wheels being bored at a table speed of 125 r.p.m. and steel wheels at a speed of 125 r.p.m. for the roughing cut and 39 r.p.m. for the finishing cut. Using carbide tools, 2,186 cast-iron wheels have been finish bored without regrinding of the tool and all boring tools have been designed to last at least eight hours without regrinding. The output of the two boring mills is either 80 cast-iron or 50 steel wheels per mill per day.

Mounting Wheels

The finished wheels move down the conveyors to the left of the boring mills under the pallet axle conveyor and, by means of the turntables, onto the longitudinal roller conveyor which takes them to a point near the mounting press. This press is a reconditioned Niles-Bement-Pond machine of 400-tons capacity which was transfered from the Lorain shop. It is to be replaced by a new type of press designed to mount 100 pairs of wheels per day, 20 more than are mounted with the present equipment.

(*Continued on page 398*)



1—O. K. tool holder
2—O. K. tool bits
3—Davis finishing cutter
4—Davis roughing cutter
5—Carey-McFall carbide cutter (c.i.)
6—Carey-McFall carbide cutter (steel)
7—Carey-McFall carbide chamfer tool
8—Carey-McFall carbide facing bar and bit
9—Outside-dial micrometer
10—Inside-dial micrometer and handle
11—Outside micrometer
12—Inside micrometer
13—Flange and tread finishing tool
14—Tread-finishing tool
15—Flange roughing tool
16—Tread roughing tool holder and bit
17—Apex tool holder
18—Apex tool bits
19—Carey-McFall right-hand carbide tool holder and bit (finishing)
20—Carey-McFall left-hand carbide tool holder and bit (finishing)
21—Carey-McFall carbide roughing tool holder and bit
22—Axle centering drill
23—Tread-roughing tool bit

Cutting tools and micrometers used at the Glenwood wheel shop

Left: The boring-mill operator is placing a new wheel on the machine with the right-hand crane. The wheel just finished is suspended from the left crane over the outgoing roller—Center: Finished axles and wheels on the conveyors await their turn at the mounting press—Right: The axle lathes along one side of the shop

The original Swiss Federal Railways 2,200-hp. gas-turbine locomotive built by Brown, Boveri & Co., Ltd., in 1941

Gas Turbine Locomotives*

By Walter Giger†

Experience on the Swiss Federal Railways with original 2,200 hp. unit built in 1941 leads way to new designs developing from 2,500 to 7,500 hp.

THE gas turbine incorporated in the first locomotive using this type of power is the last link in a chain of developments started about 1906. In that year Brown, Boveri built the first air compressor for a gas turbine constructed by a French firm. During the years 1909-12 they again participated in the development of another gas turbine and about 1924 the introduction of supercharging equipment for Diesel engines gave a new impetus to the development of this type of prime mover.

In the meantime, the extensive research work on gas turbines conducted by Brown, Boveri was responsible for the development of the Velox steam boiler. This boiler system represents a supercharged combustion and evaporative machine. The air used in combustion for this boiler was furnished by a gas-turbine-driven air compressor using the exhaust gases of the Velox boiler. Coincidentally with the introduction of the Velox boiler, Brown, Boveri developed the axial blower and with this aerodynamically better blades for the turbines and compressors.

The first real installation of a gas turbine of large power was a 4,000-kw. unit installed in 1939 in a bombproof plant of the city of Neuchatel, Switzerland. This turbine group operated with an intake gas temperature of about 1,020 deg. F and a thermal efficiency of turbine and generator of 17.38 per cent.

Up to this time Brown, Boveri and Company have built about 130 gas turbine-compressor groups and more than 2,000 gas-turbine-driven superchargers for Diesels.

The end of World War II made it possible again to get the special materials needed for the construction of gas turbines with the result that at the present time the company has under construction ten complete gas-turbine sets of from 1,600 to 10,000 kw. capacity besides one 4,000-hp. locomotive gas turbine.

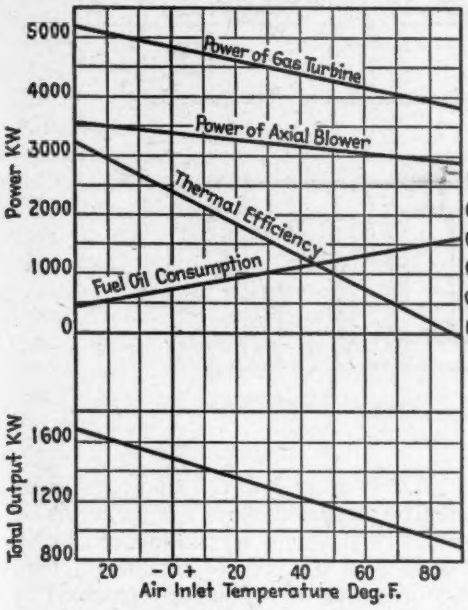
In 1939 the company started construction on a 2,200-hp. gas-turbine locomotive for the Swiss Federal Railways which was completed and placed in service in 1941. This locomotive was described in an article which appeared in the *Railway Mechanical Engineer* in February, 1943, page 69. That article described the 2,200-hp. locomotive and gave certain data with respect to the performance of it. This article brings up to date the record pertaining to that first locomotive and, in addition, offers for consideration proposed designs of gas-turbine locomotives up to 7,500 hp.

The original 2,200-hp. gas-turbine locomotive has cov-

* Abstract of a paper presented before the A. S. M. E. Metropolitan Section, New York, May 23, 1946.

† Chief engineer, traction engineering department, Brown, Boveri & Company.

ered a distance of approximately 60,000 miles since it was finished in 1941. It had to be taken out of service after its test runs due to lack of fuel oil. In May, 1943, it was possible to obtain oil for operation on a small scale on a non-electrified line of the Swiss Federal Railways. Only about 92 miles per day could be made and 22 stations had to be served on a local line. The average loading of the locomotive was about one-third of what it should be.



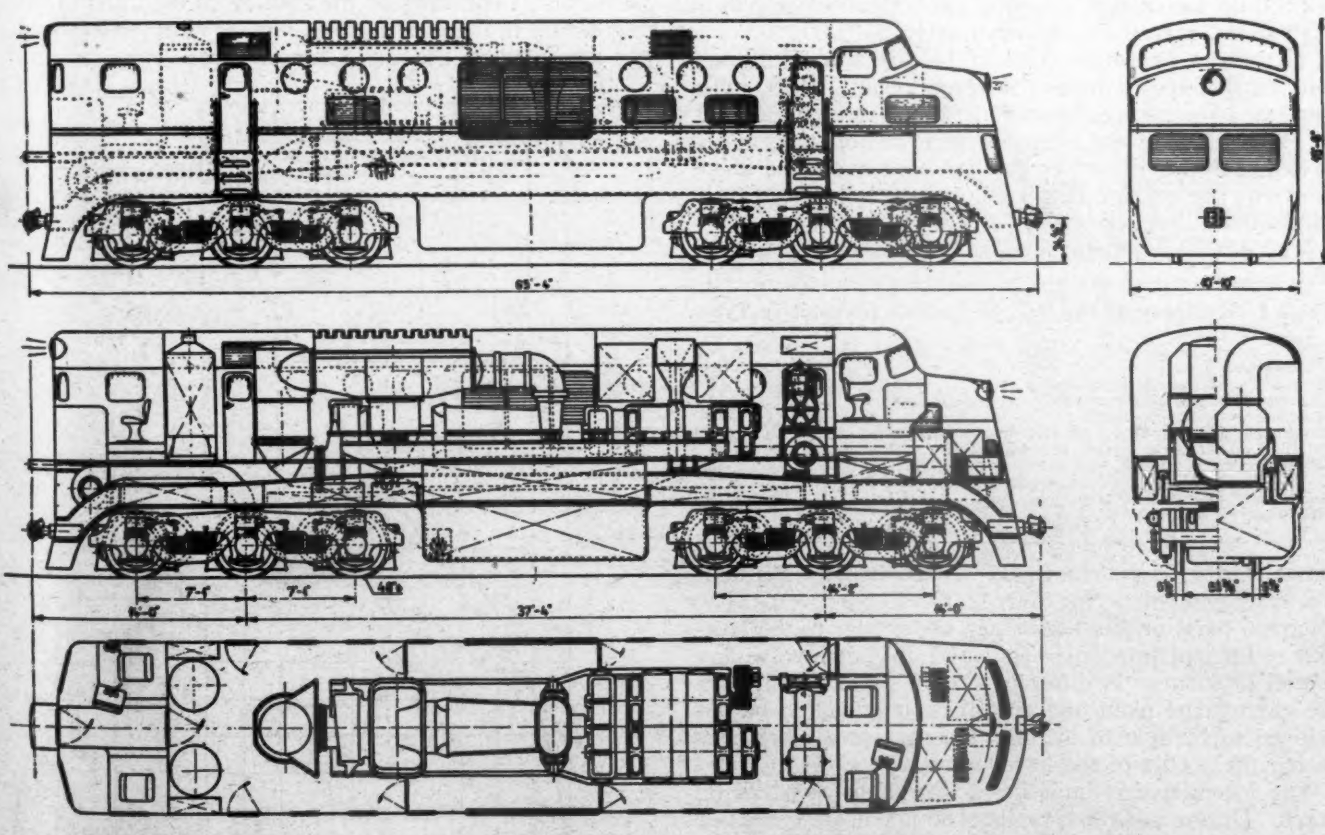
Relation of output, fuel consumption and thermal efficiency to air inlet temperature at various ratings

Considering that the gas turbine locomotive is designed for long distance travel with relatively high average loads and few stops, this was about the worst service that could have been selected. However, there was no other line available, since all the heavy traffic main lines of the Swiss Railways are electrically operated and fuel oil had to be conserved. This service was a severe strain on the gas turbine plant, since the continuous starting and stopping meant continually varying temperatures in the turbine and the combustion chamber. The number of control functions thus performed would normally only be reached in long distance runs amounting to approximately 10-15 times the miles covered.

During this service in Switzerland, which had to be interrupted again after nine months of operation due to fuel oil shortage, the turbine was in operation approximately 1,620 hr. and it was started with the Diesel-engine group not fewer than 1,560 times. In October, 1945, the Swiss Federal Railways loaned the locomotive to the French National Railways and it is now operating daily on the line from Basle to Chaumont thus making one round-trip of about 350 miles per day. On these runs the fuel consumption is about 45 lb. per 1,000 ton-miles. This fuel consumption is entirely in line with the results of many operating cost studies.

These studies included the operation of gas turbine locomotives on American railroads where the average load which the turbine has to develop is higher than on the runs from Basle to Chaumont, or for that matter on most European runs. For such trains our calculations with gas temperatures of 1,110 deg. F at the turbine intake show a fuel consumption of approximately 30 lb. per 1,000 ton-miles.

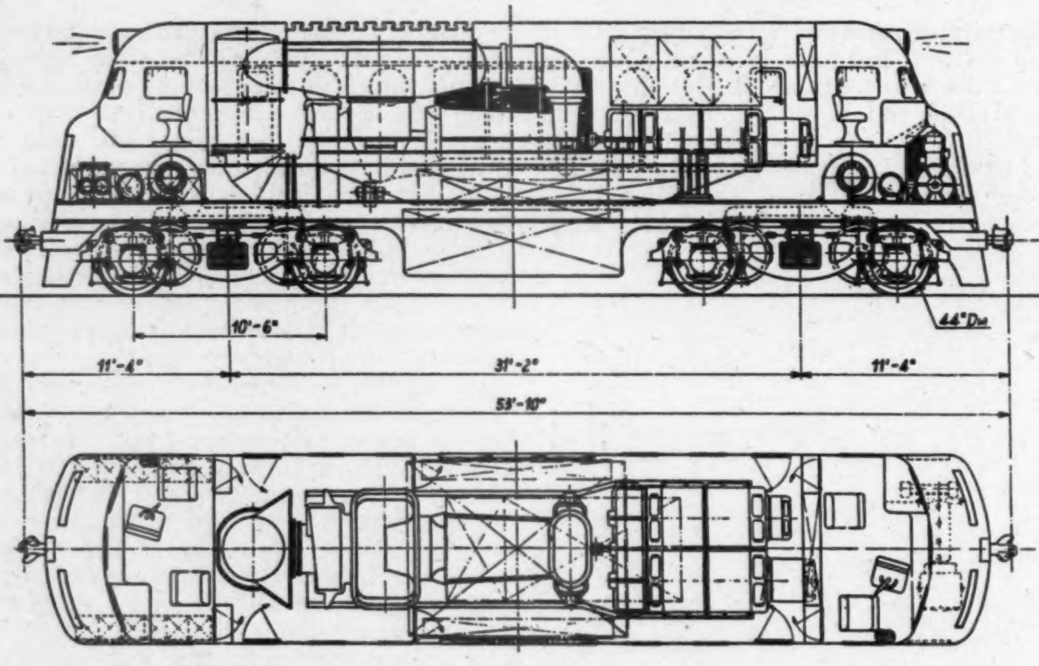
Considering the factors that enter into the economy of



Weights, lb.:	
Electrical equipment	76,600
Thermal equipment	60,600
Mechanical parts	146,200
Fuel oil, water, sand, crews, etc.	54,600
Total locomotive	338,000
Per axle	56,333

Tractive force at wheels, lb.:	
Starting, up to 11.2 m.p.h.	55,000
One-hour rating, 27.5 m.p.h.	27,300
Continuous rating, 38.5 m.p.h.	20,000
Maximum speed	90 m.p.h.

Proposed 2,500-hp. gas-turbine locomotive



Proposed 2,500-hp. gas-turbine, freight locomotive—Weight, 260,000 lb.; maximum speed, 75 m.p.h

train operation, such as first cost, interest on investment, depreciation, maintenance, fuel and crew wage we estimated that the following savings per year would be reached for gas turbine locomotives as compared with Diesel-electric units (with 1,110 deg. F of gas temperature at turbine inlet):

(a) For a passenger train of 7 cars and 750 tons, with a 2,500-hp. locomotive, covering 187,000 miles per year in high-speed operations, approximately $10,000.

(b) For a passenger train of 14 cars and 1,450 tons, with a 5,000-hp. locomotive, covering about 240,000 miles per year in high-speed operations, approximately $20,000.

These figures were estimated with fuel oil costs of approximately 2.7 cents per gal. for bunker oil and about 4.5 cents per gal. for Diesel oil, or a ratio between them of about 3.5.

The 2,200-hp. gas turbine locomotive built by Brown, Boveri is the first of its kind. That company has built electrical equipment for over 2,000 locomotives. The electrical parts of this locomotive are similar to the traction equipment previously built and did not involve any special problems. A different situation was found with the gas turbine plant and special designs had to be developed to be able to arrange the necessary machinery within the profile of the locomotive.

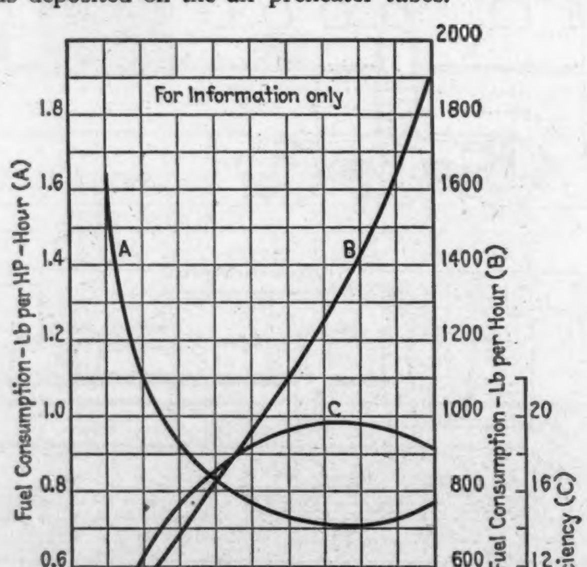
Table I—Efficiency at the Rail of Various Locomotive Types

Locomotive Type	Per Cent
Saturated steam, single expansion	5
Superheated steam, single expansion	7
Superheated steam, compound	8
Condensing steam turbine with electric transmission	8.5
850 I.hp. high-pressure steam, single expansion	10
Condensing steam turbine with gear transmission	10.2
850 I.hp. high-pressure condensing steam	12
Gas turbine with electric transmission	16
Diesel-electric locomotive	30

The locomotive is built for a maximum speed of 65 m.p.h. During test runs speeds of 80 m.p.h. were reached and the locomotive proved to be one of the smoothest running Swiss locomotives. The gas turbine and the compressor unit also lived up to expectations and no disturbances were encountered.

Some difficulties were experienced with the speed-control system of the gas turbine. In accordance with stationary practice on Brown, Boveri turbo-type machines the speed setting of the gas turbine is effected by an oil pressure system. This system was influenced by variations in the viscosity of the control oil due to changing outside temperatures. It was ultimately replaced by an electrically controlled system which worked satisfactorily.

Some difficulties also were encountered with the air preheater. Depending on the kind of oil used and of the combustion in the combustion chamber more or less soot was deposited on the air preheater tubes.



Fuel consumption and efficiency at various output ratings—2,200-hp. locomotive

For the runs in France a very heavy oil is used. On one run a combustion control link broke with the result that there was a heavy soot deposit on the air preheater tubes. This led to a chimney fire in the preheater and some of its tubes burnt out. Design changes have been made so that such troubles will not occur in the future. If the proportion of combustion and cooling air is correct smokeless combustion is easily attained, and if this is the case less soot will be deposited.

The combustion chamber presented many difficulties. All of them can be solved if the proper heat-resisting materials can be obtained. This was not possible during the war, but we are confident that the remaining difficulties will soon be overcome.

At one time the toxicity of the exhaust gases was questioned. Careful tests were made by the Swiss government munitions section. These tests showed that the gas turbine locomotive exhaust contains the smallest amount of carbon monoxide of any thermal locomotive type used today. Gas turbine locomotives can therefore operate anywhere that steam or Diesel-electric locomotives are permitted, and with greater safety.

Improvements planned for the future include the operation of the turbine at higher temperatures, thereby improving the efficiency and output, if and when materials are available to do this with safety, or to improve the efficiencies of the turbine and the compressor, thereby gaining considerably in the total economy. Another important improvement would be the combustion of coal. Extensive research has been made by Brown, Boveri in this direction, but a practical solution not yet found.

It is quite natural that the general arrangement of gas turbine locomotive will be similar to that of the Diesel-electric locomotive, the Diesel engine with auxiliaries being replaced by a gas turbine group consisting of a turbine, compressor, preheater and combustion chamber.

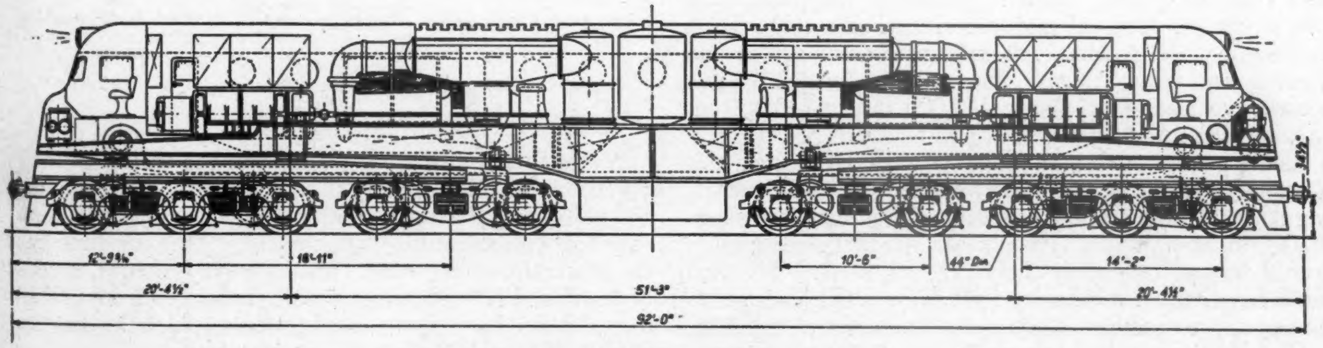
[In presenting his paper Mr. Giger showed slides of gas turbine locomotive designs of 2,500 hp., with four- and six-wheel trucks; a 4.000-hp. eight-wheel truck design and a 5,000-hp. twin-body-unit design with six-wheel trucks. This latter design is shown here in one of the drawings—EDITOR.]

A 2,500-hp. locomotive, for example, designed for a maximum speed of 90 m.p.h., is estimated to weigh approximately 360,000 lb. in working order (144 lb. per hp.). It also contains two steam boilers having a total capacity of 4,000 lb. per hr. and boiler feedwater tanks of approximately 3,000 gal. capacity. To be able to use this locomotive in both directions, when operating as a single unit, without turning it around, an operator's cab is included on the stub end.

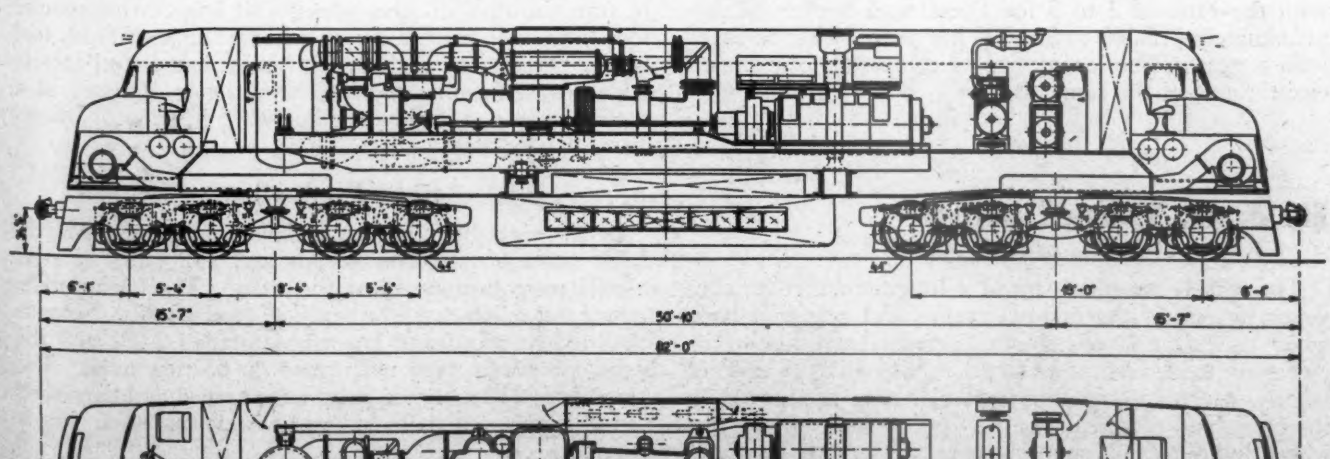
The two-unit 5,000-hp. locomotive carries sufficient fuel oil for 10 hours operation of the turbines at full load and for about 7 hours full-load operation of the steam boilers. Its starting tractive force is about 110,000 lb. and the one-hour rating is 55,000 lb. at 27.5 m. p. h.

Table II—Characteristics of 2,500-Hp. Gas Turbine Locomotive

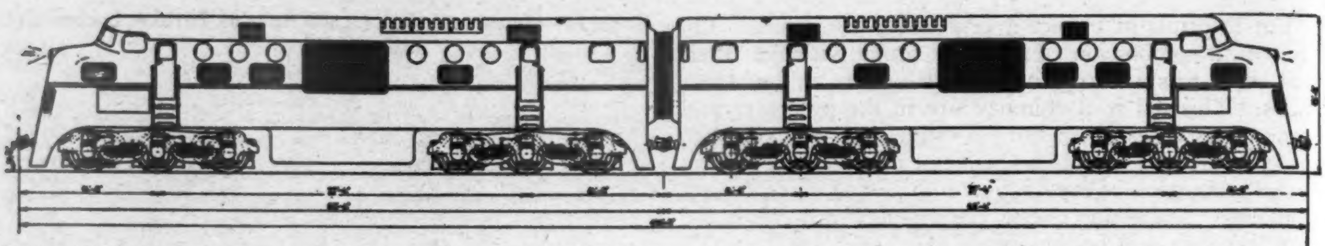
Total weight in working order, lb.	338,000
Weight per axle, lb.	56,333
Tractive force:	
Starting, lb.	55,000
One-hour rating, lb. (at 27.5 m.p.h.)	27,300
Continuous rating, at 38.5 m.p.h., lb.	20,000
Maximum speed, m.p.h.	90
Weight of electrical equipment, lb.	76,600
Weight of thermal equipment, lb.	60,600
Weight of mechanical parts, lb.	146,200
Weight of fuel, water, sand, crew, etc., lb.	54,600



Elevation of a proposed 5,000-hp. locomotive design



A 4,000-hp. gas-turbine locomotive—Weight, 440,000 lb.; maximum speed, 160 m.p.h.



Total weight of locomotive, lb.	676,000
Weight per axle, lb.	56,333
Tractive force at wheels, lb.:	
Starting, up to a speed of 11.2 m.p.h.	110,000
One-hour rating, 27.5 m.p.h.	54,600
Continuous rating, 38.5 m.p.h.	40,000
Maximum speed	90 m.p.h.

Proposed 5,000-hp. gas-turbine locomotive

During our various investigations of tractive-force requirements we often have come across conditions where high horsepower ratings are necessary. As a matter of fact most high-speed passenger and freight trains today, depending, of course, on their weight, ruling grade and speed, require from 4,000 to 6,000 hp. Power demands in the future will be even higher than these. The 2,500-hp. gas turbine unit mentioned above presents an ideal all-around locomotive for light service as a single unit or as 5,000-hp. or 7,500-hp. used in multiple-unit.

Studies undertaken resulted in the design and the subsequent construction of a 4,000-hp. gas turbine set which was recently finished and is now on test in our works. Built along the same principles as the 2,500-hp. unit but with many improvements, this new gas turbine set is expected to show an efficiency of approximately 22 per cent as against 19.6 per cent for the 2,500-hp. unit.

In a 4,000-hp. passenger locomotive equipped with this new turbine group, the generator group is gear driven and consists of four smaller generators assembled into one structure. The cab and underframe assembly rest on two eight-wheel trucks. All axles are motor-driven and there are no idling wheels. The estimated weight of this locomotive is approximately 440,000 lb. or 110 lb. per hp., and the weight per axle would be about 55,000 lb.

Being geared for a maximum speed of 110 m.p.h., this locomotive would develop approximately 75,000 lb. starting tractive force and the one-hour rating would be about 30,000 lb. at 40 m.p.h. At full load the fuel consumption would be approximately 2,600 lb. per hour. The fuel tanks have sufficient capacity for 13 hours full load operation or approximately 16 hours at 75 per cent of full load.

Cost studies were also made for this 4,000-hp. locomotive and, at the same fuel-oil prices previously mentioned with the ratio of 3 to 5 for Diesel and bunker oil, approximately $15.000 to $16,000 per year should be saved with a gas turbine locomotive as compared to a Diesel-electric unit of the same size.

B. & O. Wheel Shop

(Continued from page 393)

The wheels are lifted from the longitudinal roller conveyor by one of the one-ton cranes and a special hook which raises the wheels from a horizontal position on the conveyor to a vertical position in the air. A pair of wheels, selected to match a particular axle, are moved by the crane and placed in the vertical position on the two wheel dollies at the mounting press. The axle is moved from the pallet conveyor and positioned on the axle jack between the two dollies where protecting collars are placed around the journals. After the axle jack is raised or lowered to center the axle with respect to the wheels and center of axle scribed, the wheels are moved onto the axle, the jack is lowered and the wheels are rolled into position on the mounting press.

After mounting, the pair of wheels is rolled out of the opposite side of the press and either loaded directly into a wheel car inside the shop or moved by a dolly to the outside storage tracks. The location of the new press as shown in the layout drawing of the shop will permit the wheels to be rolled outside of the shop to the storage tracks without the use of a dolly.

Operation Data—Glenwood Wheel Shop

Operation	Machine Tool	Time, Min.*	Cutting Tools
Dismounting wheels, pairs	Chambersburg 600-ton Press	4	
Mounting wheels, pairs	Niles-Bement-Pond 400-ton Press	6	
Turning steel treads, pairs	Sellers 50-in. type RB wheel lathe	44	High-speed steel (18-4-1)
Truing and rolling journals, mounted pairs	Betts-Bridgeford double-end gap-type	30	Carbide for cutting; stellite rolls for burnishing
Truing journals and wheel seats, second-hand axles, pairs	Niles No. 3 type double-end, center-driven lathes (3) Betts-Bridgeford double-end, center-driven lathe (1)	32	Carbide for journals; high-speed (cobalt) for wheel seats
Burnishing journals, second-hand axles, pairs	Niles double-end brunishing lathe with opposed rolls	10	Stellite rolls
Boring cast-iron wheels, each	Niles plain hydraulic-feed wheel boring mills with table brake and R.H. and L.H. cranes (2)	6	Carbide for roughing and finishing
Boring steel wheels, each	Niles plain hydraulic-feed wheel boring mills with table brake and R.H. and L.H. cranes (2)	9	Carbide for roughing; high-speed (18.4-1) for finishing

* Average floor-to-floor.

Mounted pairs of wheels requiring the truing of their journals are rolled directly to a Betts-Bridgeford double-end gap-type lathe having both carriages equipped with an opposed-type burnishing attachment. This machine has tail stocks furnished with Timken roller bearings, speeds of 3, 47, and 52 r.p.m. and four feed changes from 0.0137 in. to 0.046 in. Using carbide tools, the lathe has an output of 16 pairs of wheels in eight hours.

A Sellers standard 50-in., Type RB wheel lathe is used to turn the tires of steel wheels. It has two compound tool slides each equipped with a Sellers smooth-finish tool holder taking four tools and with hardened-steel inserts under fixed forming tools. This lathe is operated at a speed of 17 r.p.m. and has an output of 11 pairs of wheels in eight hours.

Shop Production

In 26 eight-hour working days during last March, 2,305 pairs of cast-iron wheels and 192 pairs of steel wheels were demounted at the shop. The boring mills turned out 3,966 cast-iron and 194 steel wheels. Second-hand axles turned and burnished totalled 2,001 and the same operations were performed on 65 new axles. The journals of 410 mounted pairs were turned and burnished and 261 mounted pairs of steel wheels had their treads turned.

A total of 2,080 pairs of wheels, including 97 pairs of steel wheels, were mounted during the month. The total average production per day was 107 pairs of wheels. The output of this shop is gradually increasing as more refinements are made in the operation and equipment.

Program

A. A. R., Mechanical Division

Twentieth Annual Meeting to Be Held at Congress Hotel, Chicago, August 8 and 9

Thursday, August 8

10 A.M. Address by L. L. White, vice-president (operations), Chicago & North Western

Address by W. J. Patterson, member, Interstate Commerce Commission

Address by Clark Hungerford, vice-president, Operations and Maintenance Department, A.A.R.

Address by Chairman R. G. Henley, general superintendent motive power, Norfolk & Western

Report of General Committee

Report of Nominating Committee

Discussion of reports on:

Brakes and Brake Equipment

Couplers and Draft Gears

Locomotive Construction

Lubrication of Cars and Locomotives

Journal-Bearing Development

Friday, August 9

9 A.M. Discussion of reports on:

Arbitration

Prices for Labor and Materials

Geared Hand Brakes

Tank Cars

Loading Rules

Wheels

Specifications for Materials

Car Construction

Thermal Stresses in

Wrought-Steel Wheels

By Reid L. Kenyon *

Stress theory of thermal cracking of rims, and of extensive plate ruptures accompanying rim failures, developed and demonstrated by ten years of study in Armco laboratory—Wheel-testing machine permitting drag braking beyond service requirements a continuing factor in study of wheel metallurgy and mill practice

THE increasing severity of service to which railroad wheels are today subjected has created several problems. In high-speed passenger service, the chief problems are safety, resistance to thermal cracking, and resistance to wear. For a period of over ten years, we have carried on a comprehensive program of research at the American Rolling Mill Company directed toward a solution of these problems. These studies have proceeded along several lines in an effort to determine the most important factors and the proper balance between them in making (1) safe wheels, and (2) serviceable wheels, and have directed our work, first, to a study of internal stresses in wheels as affected by service as well as manufacturing conditions, and then to an improvement in respect to serviceability.

An examination of wheels in service has shown that thermal cracks may be the source of a wheel failure that can result in a serious derailment. An example of this sort of failure is shown in Fig. 1. This is a rather thin-rimmed wheel, and it is believed that the deep thermal crack at *O*, illustrated also in Fig. 2, weakened the rim enough to initiate this failure. For this reason, resistance to thermal cracking is a primary requirement for a safe wheel.

Cause of Thermal Cracking

In order to minimize the dangers arising from thermal cracks, it was necessary to understand the mechanism of their formation. Our attack on this problem started with the examination of wheels in service followed by a metallographic study of the changes in structure produced in the tread of the wheels as the result of brake action. It was found that when thermal cracks occurred, there was invariably a change in the micro structure of the surface layers of the tread, as shown in Fig. 3. The heat-affected area is rather deep, especially toward the left-hand or outer edge of the rim. An examination under the microscope reveals the tread surface to be martensitic, a structure of steel that is very hard and brittle. Farther in, as the effect becomes less, the structure is pearlite, the original condition all through the rim. There is a more or less gradual transition throughout the thickness of the heat-affected area. In order to change the structure of this steel from the original pearlite to martensite requires that it be heated to a temperature of at least 1.350 deg. F. and then rapidly cooled. A study of all of the effects of such an intense localized heating of the surface layers of the tread led us to the formulation of a stress hypothesis of thermal cracking.

In order to develop this hypothesis, let us trace what happens to a section of a wheel in service. If the brakes are applied when the train is running at high speed, a strip of metal on the tread surface of the wheel will be heated to a high temperature and the strip will tend to expand. The expansion is restricted, however, by the relatively cool and more rigid metal beneath, and since the heated tread goes through a plastic state (in the neighborhood of 1.350 deg. F.), it will be compressed and permanently deformed or "upset." On account of the circular shape of the wheel, the expansion of the tread metal is restricted most in the circumferential direction and the plastic movement of tread metal must be sideward and outward. After the brakes are released, the tread metal cools quickly by conduction of heat into the rest of the rim and into the rail, and tends to contract. But on account of the previous upsetting, this contraction sets up hoop tension in the tread. Every repetition of this heating and cooling cycle tends to increase this hoop tension stress and eventually it may equal the tensile strength of the steel. Moreover, the sudden cooling of the tread metal from above 1.350 deg. F. constitutes a quench which produces the hard, brittle,

* Associate director, research laboratories, American Rolling Mill Company, Middletown, Ohio.

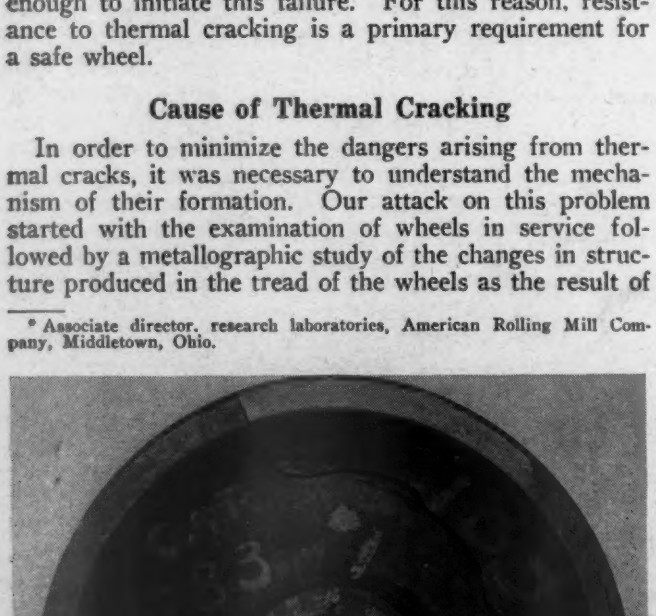


Fig. 1—Wheel failed in service due to combination of deep thermal cracks in the rim and stresses built-up in the plate due to excessive brake action

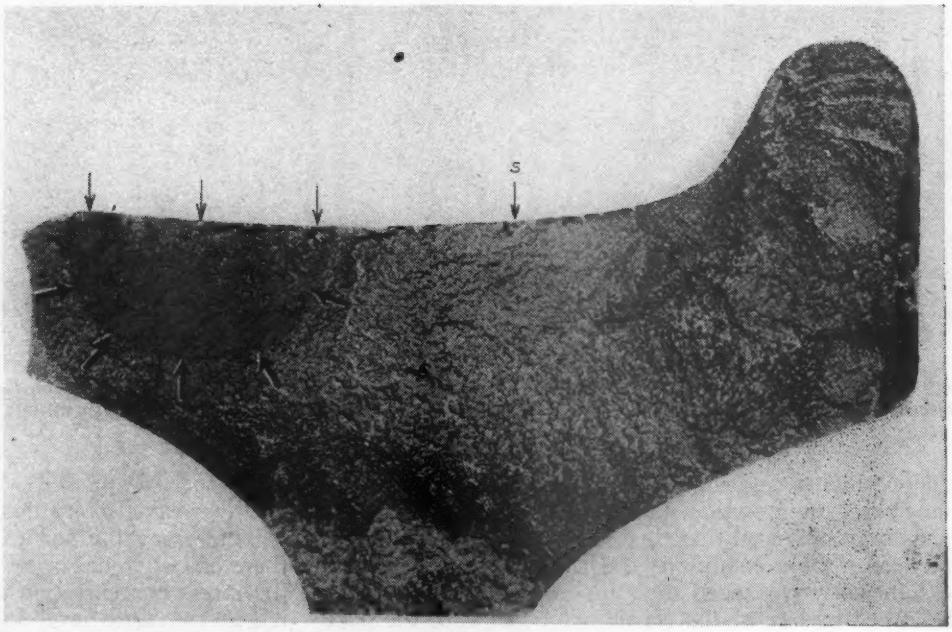


Fig. 2—A deep thermal crack on one of the fractures shown at *O* in Fig. 1

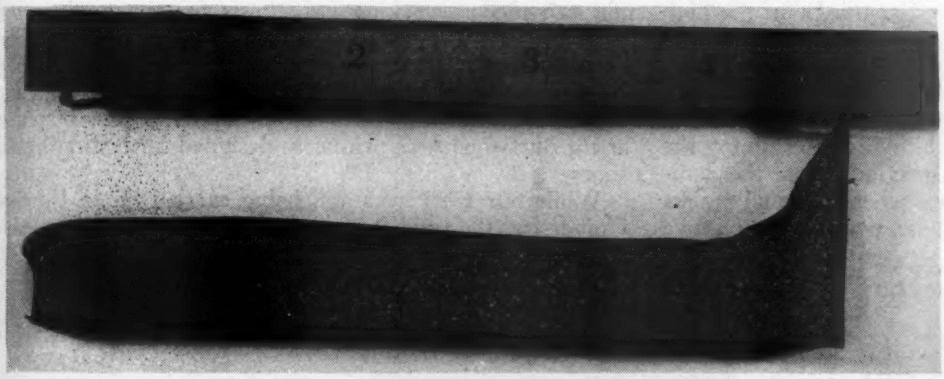


Fig. 3—Etched section through the rim of a thermal cracked wheel, showing heat-affected metal near the outer edge of the tread

martensitic structure. When this metal is highly stressed, it cracks instead of elongates, and this is the origin of the thermal cracks. This working hypothesis has stood the test of about ten years of observation and checking against laboratory tests and actual conditions of railroad service. It may be properly called the *stress theory of thermal cracking.*

Need for Wheel Testing

When we first formulated this hypothesis over ten years ago, there were no facilities available for testing full-size car wheels under conditions that approximated the severity of railroad service. The nearest approximation that could be obtained was on a machine designed to test cast-iron brake shoes. Arrangements were made to make use of the one at Purdue University, Lafayette, Ind., and for a period of about three years we conducted extensive tests of wrought-steel car wheels on this machine.

The method employed was to revolve a 33-in. wheel at a speed equivalent to 100 miles an hour on the modified machine and then bring it to a stop with the application of 20,000-lb. brake-shoe pressure, making the tread of the wheel red hot around the entire circumference. Only eight applications like this were required completely to wear down a standard brake shoe. After the brake application, the wheel was cooled with ice and a water spray. This cycle was repeated until the wheel thermal cracked as shown in Fig. 5. As far as is known, these are the first thermal cracks deliberately produced in a wrought-steel car wheel under controlled test conditions.

Development of Plate Stresses

Although we had succeeded in developing a working hypothesis for thermal cracking, it was still necessary to explain what caused the rupture to continue around the plate or web of the wheel in a circumferential direction as shown in Fig. 1.

The high hoop stresses in the rim are believed to be the cause of the thermal cracks, but they also tend to cause radial compression forces to operate on the web or plate portion of the wheel as indicated in Fig. 6. The arrow on the tread represents a radial force equivalent to the circumferential tension in the rim. Since the plate of the wheel is not in direct line with this force, there is a tendency for it to undergo a bending movement which actually increases the dish of the wheel. That this does actually occur as a result of heavy brake applications has been verified by measurements of wheels on the testing machine. It appears that the plate or web of the wheel acts as a cantilever supported at the hub, and the deflecting force is applied at the rim. The increase in the dish of the wheel flexes the plate. Owing to the large volume of metal in the plate, it is conceivable that an extremely large amount of energy could be stored up by its elastic deformation.

According to the stress theory of thermal cracking, repeated heating and cooling cycles have a cumulative effect in building up the tread stresses, and these in turn

Fig. 4—Micrograph at 50 diameters magnification showing zone through the heat affected area of Fig. 3—The white martensite portion is adjacent to the tread where the heating and quenching was most drastic—This gradually tapers off into the original pearlite structure of the rim

produce higher and higher plate stresses. Although in many cases the growth of thermal cracks may be gradual, it has been observed that they may form quite suddenly, and under these conditions the rim of the wheel could be sufficiently weakened to result in a sudden release of the stored energy of the elastic deformation of the plate of the wheel. Under these conditions it was believed that the fracture would be propagated from the thermal crack in the rim down into the plate, and at this point the high radial compressive stresses in the plate of the wheel would produce a tearing action which would literally rip the rim of the wheel from the plate and hub. Such failures would be practically instantaneous, and, therefore, hazardous because of the impossibility of determining the dangerous stress condition by inspection before the damage had occurred. In other cases where thermal cracks grow more gradually, it should be possible to remove badly thermal-cracked wheels before the rims are sufficiently weakened by deep, long cracks. Although machining away the surface metal down to the bottom of these cracks would be an economic loss, it would prevent the stress concentration at the bottom of the cracks and reduce the stress level somewhat by removing the highly stressed, heat-affected surface layers of the tread.

This extension of the stress theory of thermal cracking provided a working hypothesis for the explanation of the mechanism of a certain type of wheel failures. The verification of this hypothesis came later after we had constructed a specially designed wheel testing machine which overcame the serious limitations of the machine at Purdue which was primarily designed for testing brake shoes.

While our work was still being carried on at Purdue University, the need for a quantitative method for meas-

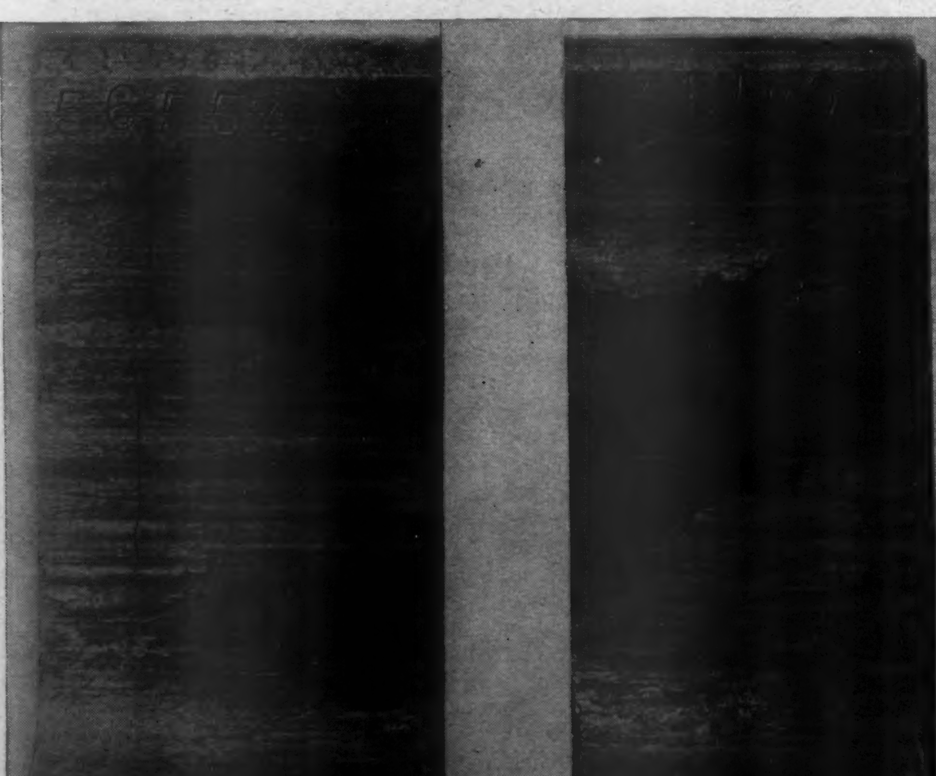


Fig. 5—Typical thermal cracks produced on the tread of a wheel during test

uring plate stresses became more and more apparent. If such a method were available, it should be possible to check the validity of the hypothesis just presented. A method was developed which was basically similar to that used by the National Bureau of Standards for studying stresses in bridges, airplanes, and other structures.[1, 2, 3, 4] Four intersecting gauge lines are laid out on the surface at each point where the stresses are to be determined as shown in Fig. 7. By the use of a special strain gauge, these gauge lengths are measured to 1/30,000 in. Changes in length between the gauge points as measured by this special strain gauge can be interpreted in terms of the corresponding stress in lb. per sq. in. Due to the complicated shape of the wheel and the restraining effect of the surrounding metal, it is necessary to take into consideration the simultaneous effect of stresses in various directions. This is the reason for employing four gauge lines intersecting in a common point. The calculation of the principal stresses as well as those in any desired direction through the point may be carried out by employing the principles of mechanics and the mathematical theory of elasticity. A presentation of the basic theory as well as a discussion of the technique of making the measurements and special time-

Fig. 6—Typical radial wheel section showing the radial force which results from hoop tension produced by cooling stresses in the tread after heating from brake-shoe friction—The dotted outline indicates movement of the wheel toward greater dish as a result of this radial force

saving devices for computing the results have been fully described in a paper by Kenyon and Tobin.[5]

This method of stress measurement has been of value in several ways. It has been possible to measure not only the change in stresses resulting from artificially imposed conditions in the laboratory and on the wheel-testing machine, but also the actual conditions of service measured under regular railroad cars. These tests can be made by measuring the gauge lengths on the wheels before and after subjecting them to the specified conditions, and this test is non-destructive. Another modification of the test has been developed for measuring the initial or the total stresses in the wheel by sawing out the portion of the wheel that contains the gauge marks. This is a destructive test but gives information that can be obtained in no other way.

One of the first uses that was made of this method for measuring stresses was to see if there was any change in plate stress due to repeated brake-shoe applications in the wheel-testing machine. Gauge marks placed on the front and back face of the wheel at two locations 90 deg. apart were measured before the test was started and again after successive applications of the brake shoe pressure. Several wheels were tested and in each case

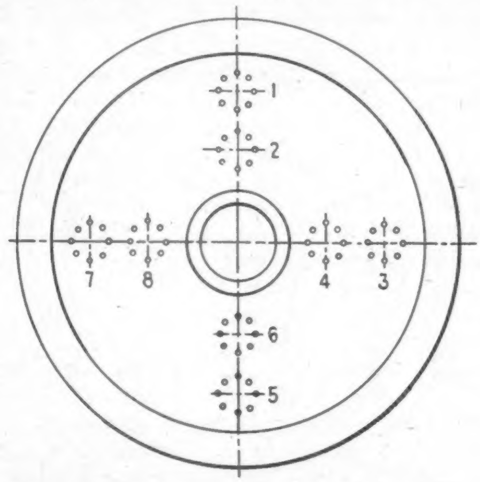


Fig. 7—Location of gauge lines and "rosettes" for the measurement of plate stresses

there was a progressive increase in the amount of stress change. Measurement of the dish of the wheel showed this also increased progressively with the number of brake applications. The actual amount of increase in stress differed with the various tests but ranged from 12,000 to as high as 38,000 lb. per sq. in. Fig. 8 shows the stress increase in the plate of a wheel after seven dragging brake applications (30 min. each at 60 miles an hour with 3,500 lb. pressure on each of two brake shoes.) The two sets of results for the two locations at each position (front side, near rim and near hub and opposite on the back side) are indicated by the duplicate figures on the chart.

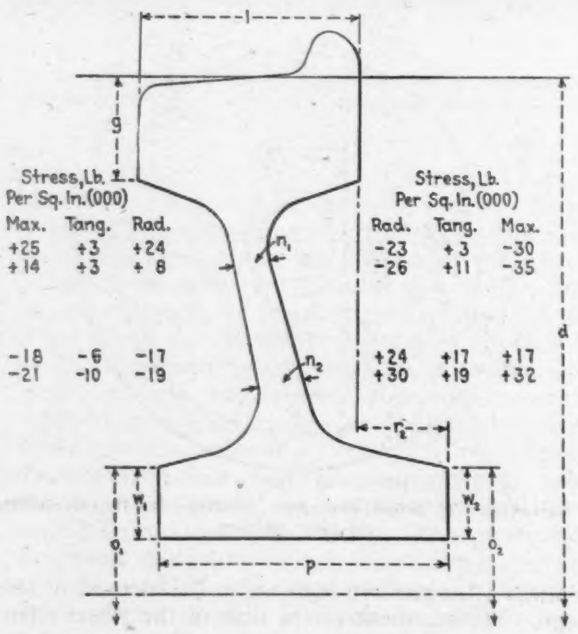
More Returns from Wheel Testing

The means of measuring stresses was a valuable adjunct to the testing facilities offered by the Purdue University brake-shoe testing machine. The results of stress measurements were so encouraging that it was decided to measure similar changes in wheels in actual railroad service. Gauge marks were placed on several new wheels before they were installed under passenger cars and measurements were taken at intervals during the life of the wheels. This same procedure has been followed in a number of other instances, and although the magnitude of the stress changes varies widely in different types of service and on different wheels under different cars in the same type of service, the changes are always in the same direction. In other words, there is a tendency for the dish of the wheel to increase and for the plate of the wheel to be subjected to radial compressive forces. Fig. 9 shows the build-up in plate stresses measured on two pairs of wheels in suburban passenger service.

While these service tests were in progress at Purdue University, another line of investigation had been under way in the Research Laboratories to study the behavior of a wide variety of steels in small-scale laboratory thermal cracking tests. It was found that the steels that

[1] W. R. Osgood, Determination of Principal Stresses from Strains on Four Intersecting Gage Lines 45 Deg. Apart, Bur. of Std. Journal of Research, Vol. 15, Dec. 1935, p. 851.
[2] A. H. Stang and M. Greenspan, Graphical Computation of Stresses from Strain Data, Bur. of Std. Journal of Research, Vol. 19, Oct. 1937, p. 1034.
[3] W. R. Osgood and R. G. Sturm, Determination of Stresses from Strains on Three Intersecting Lines and its Application of Actual Tests, Bur. of Std. Journal of Research, Vol. 10, May 1933, p. 559.
[4] A. H. Stang, M. Greenspan, and W. R. Osgood, Strength of a Riveted Frame Having a Curved Inner Flange, Bur. of Std. Journal of Research, Vol. 21, Dec. 1938, p. 853.
[5] Stresses in Car Wheels, R. L. Kenyon and Harry Tobin, *Railway Mechanical Engineer*, December, 1941, and January, 1942.

were most subject to thermal cracking were those with lower critical cooling rates. All of the alloy steels owe their particular properties to their retarded critical cooling rate, but this makes them entirely unsuited for railroad car wheels because of their increased susceptibility to thermal cracking and to the formation of extremely hard, brittle transformation products on the surface of the tread after brake applications. Even the higher-carbon high-manganese wheels of standard A. A. R. analysis



Wheel dimensions, in.

d — 36	O_1 — 10
g — 2½	O_2 — 10
l — 5½	w_1 — 1
n_1 — ¾	w_2 — 1
n_2 — 1	p — 7
r_2 — 2-7/16	

Fig. 8

were found to be more sensitive to thermal cracking than desirable. The carbon and manganese in a 0.75 carbon 0.75 manganese steel is high enough to affect the critical cooling rate and influence the behavior of the steel during the extremely rapid cooling that follows the brake application.

These studies led to the discovery of the general principle that rapid transformation rates are essential for high resistance to thermal cracking. As a result, various modifications in analysis,[6] including the lowering of the manganese and the addition of aluminum, have since been developed to obtain faster critical cooling rates and the greater resistance to thermal cracking which results therefrom. Wheels made from some of these special compositions were so resistant to thermal cracking that tests of them had to await the completion of a more powerful testing machine that was capable of imposing more severe test conditions.

A Better Wheel-Testing Machine

By this time the work at Purdue University had progressed far enough to demonstrate the value of this type of testing and also to indicate the advantages that would be gained by using a machine that was specially designed for testing wrought-steel wheels and that could be made to simulate more closely the actual conditions of the service. Armco engineers designed a special wheel-testing machine[7] which was constructed in the wheel works of the American Rolling Mill Company at its plant in Butler, Pa.

This machine, like the one at Purdue, had a large flywheel to provide inertia proportional to that which would be imposed on a single car wheel under a fully loaded railroad freight car. The machine differed, however, from the brake-shoe testing machine at Purdue in practically every other respect. Sufficient power was provided by means of a large electric motor to drive the wheel at speeds in excess of 150 miles an hour. Two brake-shoe holders were provided in relative positions similar to that of clasp brakes and actuated by hydraulic pressure which could be accurately controlled and built up to pressures of 50,000 lb. per brake shoe or higher. Special provisions were made also for dragging the brake shoes under heavy pressure for long periods of time at speeds up to 60 miles per hour, thus simulating the action of trains on heavy mountain grades. In addition to these basic features which were all designed to make it possible to subject the wheel to even more severe conditions than would be attained in present service, the machine was provided with ample safety devices as well as automatic controls and numerous recording instruments.

With the completion of this machine in 1938, the experimental work was transferred from Purdue University to the Butler, Pa., laboratory. The increased power and versatility of the Armco wheel-testing machine made it possible to extend the scope of the previous testing program.

One of the most important advantages of the new machine was its capacity to apply long, heavy dragging brake applications which resulted in a higher build-up of stresses than the short, heavy applications to bring the wheel to a stop after the motive power was shut off. This is probably due to the greater depth of the heat-affected layer on the tread caused by the longer brake applica-

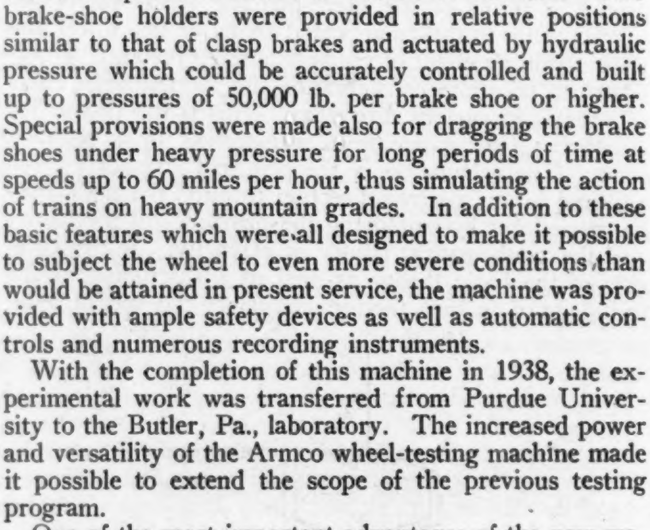


Fig. 9—Change in maximum plate stress with service miles

tions. Measurements have shown that by this method of testing it is possible to raise the stresses in the plate of the wheel as high or higher than the yield strength of the material. In such cases the strain measurements are so large that the steel must have been stressed well beyond the proportional limit, because the calculated stresses on the basis of Young's modulus of elasticity would be above the yield strength of the material. Inasmuch as plastic deformation would result from stresses of this magnitude, this would automatically reduce the stresses until they leveled off at the yield-strength value. Such a condition

[6] U. S. Patent No. 2,273,047.
[7] U. S. Patent No. 2,293,344.

of stress, however, is high enough to be very dangerous, especially if the rim of the wheel is weakened by a deep thermal crack.

Testing for Plate Failure

On account of the danger of a wheel bursting if a thermal crack were produced in the rim after high plate stresses were built up by drag testing, in our earlier work

Fig. 10—Wheel failed in service due to combination of deep thermal crack and built-up plate stresses

we carefully avoided any sequence of brake application that might cause such a result. We did drag-test a large number of new wheels and measured the build-up of stress in the plate of the wheels. None of these had any thermal cracks in the rim, and so it was decided to introduce an artificial thermal crack in the form of a hacksaw cut through the rim. The anticipated result followed, accompanied by a noise like that of a cannon. The crack progressed down through the rim into the plate of the wheel and around the plate in a circumferential direction, and was closely similar to the crack in a wheel, as shown in Fig. 10, which failed in actual service. This test has been repeated many times with similar results and seems to confirm the stress theory of plate failure of car wheels.

During all of our testing work, it had been our intention to cool the wheel down to room temperature after each brake application before starting the next one. This was done in order to minimize the possibility of a wheel bursting on the machine due to the increased hoop tension resulting from the cooling stresses. It was our conviction that a wheel could never "blow up" except while it was cooling. If this were true, it should be possible to drag-test a thermal-cracked wheel providing it was quickly slowed down to a safe speed at the conclusion of each drag test. The cooling of the wheel by means of streams of water could then be carried on at a very slow speed. This procedure has been followed and many wheels have been broken on the machine during the cool-down period while rotating slowly under a stream of water. In no case has a wheel ever broken except during the cooling cycle. This is further evidence of the correctness of the stress theory of plate failure.

The wheel testing machine at Butler, the method for measurement of stresses, and other research tools developed by Armco engineers are being used to study not only the behavior of wheels under modern railroad service conditions, but to test the behavior and maintain the high quality of the standard and special analysis wheels which these new tools have helped in developing. They are also being used for the development of further improvements in wheels to meet the ever-increasing demands of railroad transportation.

It is no longer necessary to await the results of time-consuming observations in service when new developments in car wheels are to be tried out. Without risk to the safety of railroad transportation, advance information can be obtained in the laboratory under conditions even more severe than actual service. In this way the development of these methods of testing has greatly accelerated the progress in wheel improvements.

* * *

The New York Central's new high-speed freight train, the "Pacemaker," making its first run from Buffalo to New York

EDITORIALS

Car Service Improvements of the Future

Progressive car-department officers are looking earnestly into the future to see what improvements can be made in operating and maintenance practices, as well as the service rendered by both freight and passenger cars. Many suggestions are advanced and, as a practical matter, those which promise the largest results quickest should be given first consideration.

Thinking about freight cars for a moment, there is no question that cars are being delayed longer than necessary at interchange gateways and often inspected several times before getting through a large terminal. In many cases, there is a delivery line inspection, receiving line inspection and outbound yard inspection, all three inspections being made within a relatively short period.

Obviously, such multiple inspections, now common in most large terminals, are not required in the interests of safety and any other reasons should be "weighed in the balance and found wanting" when the result is unnecessary delay in forwarding cars and lading to destination. Experienced car officers believe that cars must move through major gateways in three hours or less, instead of 10 hours, as is often required at present, if railroads are to hold traffic in the keenly competitive era ahead.

Car-department forces, like railway labor in general, have an important stake in railroads and must co-operate with managements in bringing about necessary changes and improvements, or their means of livelihood will be be seriously curtailed. Car inspectors and supervisors must work together in making sure that freight cars are bad ordered only when necessary, as this entails delays and expense. Experience, good judgment and common sense are all required in inspecting cars to avoid shopping cars later found not to need repairs.

One car-department head who believes thoroughly in educating train yard forces and developing an adequate number of apprentice graduates to replace the trained mechanics who retire due to age or other reasons, says that these young men should be educated not to become "car stoppers" which anyone can do, but to keep cars moving to the maximum possible extent consistent with safety.

The perennial subject of more effective commodity carding deserves still further intensive consideration. Many empty car miles are wasted due to improper selection and setting of cars for prospective loads. If a car inspector specifies that a car is suitable for flour loading, no major change in car condition is likely to occur while the car is moving even 300 miles to the point of loading and yet many such cars make this movement and are recarded to a lower commodity with attendant loss of empty car miles and additional per diem expense.

It is probably that future transportation costs will be based on using box cars loaded both ways, and sound judgment in commodity carding will be essential to secure this important transportation result. Empty car movements in the future will obviously depend more and more upon accurate commodity carding and dependence can no longer be placed on inspecting cars from the ground without going inside. Neither can the wide variance of opinion between inspecting forces be tolerated in the interest of efficient car handling and service.

Improved standards of maintenance are indicated to permit safe operation at modern high train speeds and also to minimize service failures with their attendant delays. Too many loaded cars are being delayed on account of being in bad order. The answer is, of course, to repair cars as fully and generally as possible while they are empty and provide an adequate number of high-speed repair tracks by means of which bad-order cars, loaded through error, may be quickly given sufficient repairs to permit forwarding these cars in their regular scheduled trains if this can be done.

Practical car men ask for still more standardization and interchangeability of such freight-car parts as side frames and bolsters of conventional trucks, side bearings, center plates, striking castings, draft castings and attachments, side doors, brake beams, coupler release rigging, etc. They also ask for cars designed for easier inspection and maintenance. For example, how about designing the underframes and brake-cylinder applications so that pistons can be seen from either side of cars thus avoiding in some instances the need of additional inspectors at terminals to make air-brake tests.

Continued advances in brake-rigging design are definitely in order; more and more car men look longingly to roller bearings to reduce maintenance and lubricating costs and also practically eliminate hot boxes; built-in grain doors for box cars are called for, also removable bulkheads to cover the two smaller side doors and permit using automobile cars for grain and similar loading. Truck weights are still too large a proportion of total car weight in most instances, the unsprung weights in particular needing reduction as far as practicable.

The car department head previously referred to suggests in the passenger-car field design and decorative features developed with more consideration to maintenance; air-conditioning equipment made more efficient; both air conditioning and heating better adapted to individual passenger requirements; seat supports streamlined and all corners rounded for greater ease in cleaning cars; water systems available for easy cleaning of cars both inside and out; baggage and express cars with self-contained pivoted platforms in the door openings to facilitate loading and unloading; baggage, express and

mail car lights which can be reflected to the outside at stations stops so that the addresses on packages, mail pouches, etc., can be read more easily.

These and many other ideas occur to the minds of alert and observant car officers and employees. Some of the proposals are perhaps impracticable, but suggestions for improvement of all kinds should be constantly solicited, reviewed, given a fair trial in cases of doubt and generally adopted whenever the result will be improved railway service, or reduced maintenance and operating expense.

Production Shop

Although a great many new machine tools and other repair equipments have been installed as individual items by the railroads it is seldom that an entire shop is laid out and fitted to do one particular job. While it is true that there are not many car and locomotive parts with the volume necessary to justify being handled on a production basis there have always been sufficient numbers of car wheels and axles to demount, machine and assemble on most railroads to warrant doing something about equipping a shop to produce volume work efficiently.

It is refreshing to visit a production facility such as the Glenwood wheel shop of the Baltimore & Ohio, described elsewhere in this issue, and see what happens when a real effort is made to install what most railroad machine-shop foremen can, unfortunately, only dream about. Without attempting to acclaim this plant as the ultimate in wheel shops, and the B. & O. will admit that some additional improvements are not only necessary but will be made, a great deal of credit is due nevertheless both to the men who planned it and the management that approved and paid for it.

Advantage has been taken of the inherent production possibilities of new machine tools by the development of a layout that produces a straight-line flow of work through this shop as determined by the natural sequence of machine-tool and hydraulic-press operations. This layout is supplemented by material-handling equipment that accelerates the flow and reduces the non-productive time used in moving material, an operation that has a tremendous influence on the actual time a machine tool or other shop equipment is turning out useful work. The material-handling devices have also given the shop an added characteristic by removing the back-breaking manual labor associated with the lifting and moving of heavy wheels and axles. Along with these important factors in production work a shop procedure that simplifies and speeds up the machining operations has been introduced. This is the selection of only one nominal size of axle for each day's work and the use of step sizes in machining both the axles and wheels, a method that eliminates the frequent changing of machine set-ups and the making of custom-made pits for each pair of wheels. Last but by no means least is the equipping of the machine tools with the right kind of cutting tools, both high-speed and carbide.

Unless these features of the Glenwood wheel shop produced at least a reasonable return on the investment it would be futile to mention this shop and its equipment to practical railroad men. That it does so is evidenced by the savings quoted with the shop's description. The figures are good enough to make us feel that we shall see more "Glenwoods" in the near future.

Power for Train Communications

Electrical men concerned with the requirements of caboose power for train communications have compiled complete data covering the power requirements of each type of communication equipment and descriptions and specifications of all available types of power generating machinery which might be used for this purpose. Such information with recommendations for its use will probably appear in the form of a report at the forthcoming meeting of the A. A. R. Electrical Section meeting to be held late in October.

Compiled data have been given wide circulation among those most concerned, but so far have served only slightly to crystallize thinking on this subject. One man has decided to use a straight storage battery supply on cabooses with a third-rail power supply on the caboose track for charging the batteries. Another says it is impossible to apply a third-rail shoe to a freight truck but that if a 16-ft. clearance were allowed over the caboose track, a satisfactory overhead charging line could be had. He adds, however, that caboose-track charging should be used only as assurance of fully charged batteries at the beginning of the run and that most of the power should be obtained from an axle-driven generator. Another tells of an axle system used experimentally in which a 4-kw. generator driven by a flat belt was used to supply power. With a belt tension corresponding to passenger-car practice, the belt was broken on every trip by coupling shocks. When the tension was reduced to one-fourth this amount, the belt did not break but the generator output was halved. Those using endless V-belt drives with idlers say this is not a problem.

One prospective operator says, "I do not wish to put batteries on a caboose because they will not receive proper attention. At a cost which will be less than that of an axle system, I can apply an air-started 1½-kw. Diesel-driven generator. I can not get propane wherever I want it, and with such an engine, I can carry enough oil on the caboose to run it for a month." To this another replies that such an engine would not run on Diesel locomotive fuel, that it would require kerosene, that its operation would not be dependable and that fuel cost would be greater than for propane. Engines powered with propane are being used successfully, but some disagree with the use of a combustible fuel on the caboose. Gear drives and induction-type a.c. generators have been designed as equipment having the necessary rugged qualities for caboose application.

In almost all cases, provision is being made for a con-

ductor's light and for one or two more lights in the caboose. All of the power plants are of necessity of limited capacity, and when the designers are asked what can be done to avoid burnouts and failures when crews may add other loads, they suggest that overload breakers can be installed. This is a basic problem and it rests with management to work out an understanding with train operators to prevent a series of increasing demands repeatedly calling for installations of greater size. For years it has been considered lese majeste even to mention caboose lighting, but now that it has arrived through the medium of train communication the usual procedure of pussyfooting and compromise should be replaced by an agreement which will assure that train communication will not be stifled by the introduction of accessories which will make the cost of power supply prohibitive.

Why Have a Fuel Equation at All?

When the railroads first started to use motive power that burned fuel other than coal, either in the generation of steam or in an internal combustion engine, no doubt some railroad executive made an inquiry as to whether this new method of hauling trains cost more or less than the old way of using coal-burning steam locomotives. Like many another inquiry of its kind it probably started a whole train of calculations that became more involved as the operation proceeded until some statistician came forth with the observation that one couldn't make an accurate comparison of costs without taking cognizance of obvious differences in the character of the different fuels and the manner in which they were used. Out of this came the fuel equation and to this day there is no generally acceptable method of equating fuel, in the form of gasoline, oil, or even wood, to coal. Almost every railroad man who has anything to do with the use of fuel has ideas of his own.

Several months ago, in one of our contemporary publications the matter of the fuel equation was discussed and the suggestion was made that, in the true sense of the word, it was not an equation at all because the results obtained by the use of the so-called equation did not represent equality, nor even consistency.

It is true that a Fuel Association committee which has given considerable thought to this subject over a period of years has, by virtue of concentration on the subject, exerted influence is getting more and more of the railroads to use the same formula now that the use of the Diesel-electric locomotive has become widespread in all classes of railroad service in all parts of the country but when the results that are obtained by the use of a single formula by a group of railroads is observed there are more and more railroad men asking the question, "Why have a fuel equation at all?".

Let's have a look at the record and see if there is any answer to the question. Anyone can take the statement published by the Bureau of Railway Economics entitled "Unit Fuel and Power Consumption of Locomotives and Rail Cars" and set down the statistics of any group of railroads, classified according to one's own ideas as to the character of equipment, service or kind of fuel used. Not having exhausted all of the possibilities for different groupings we can not say just how many kinds of results might be forthcoming. But, just out of curiosity, we took a group of 18 railroads—8 Eastern, 5 Southern and 5 Western—all of which are large users of Diesel-electric power in switching, road freight and road passenger service. Among these roads we find variations in the use of coal, on steam locomotives, all the way from 574 to 1,138 lb. per switching locomotive-hour and from 5.19 to 7.2 gallons of Diesel fuel oil. In road freight service the consumption, on steam power, varies from 99 to 153 lb. of coal per 1,000 gross ton-miles and from 1.1 to 2.1 gallons of Diesel fuel oil per 1,000 gross ton-miles. In road passenger service, steam power uses from 10.6 to 23.1 lb. of coal per passenger car-mile and the Diesel locomotive from 0.23 to 0.64 gallons of Diesel fuel oil per passenger car-mile. These high and low figures do not show any consistency with respect to territory for, in one case, a Western road known to have poor high-priced coal and good low-priced oil showed a better oil-coal relationship than a Southeastern road with good low-priced coal and good low-priced oil.

The question has been raised as to the value of the fuel equation in the matter of steam and Diesel-electric locomotives used in the same train such as in the case of Diesel helpers on steam trains, or vice versa. Records from roads using Diesel helpers indicate that (1) it is not possible to record Diesel helper fuel oil on a 1,000 gross ton-mile basis; (2) that the consumption is considerably higher, per locomotive-mile, than on road locomotives and (3) that in helper service the actual fuel consumption records will probably result in an average oil-coal relationship, or equated value, much the same as the switching value.

Without prolonging the discussion of the relative values of oil and coal in steam and Diesel locomotives we would like here to point to the inconsistencies in whatever may be the final statistics that can be tabulated on the matter of fuel use. In what, after all, are we interested in relation to fuel use? Are we not interested in reducing the ultimate cost of the fuel used to do a unit of work? For years we have used pounds of coal per 1,000 gross ton-miles as a measure of fuel use in steam power all the while knowing that it is not possible directly to compare the figures of one road with another without taking certain related conditions into consideration. Now we have a still more accurate measure of Diesel fuel use primarily because our methods of measuring fuel are more accurate.

Of what possible value is a fuel equation and its resultant figures when all we do is to take two reasonably acceptable bases of comparison, scramble them up by the use of a formula which many question the accuracy of and come out with a resultant set of figures which no one can unscramble after they are cold. So, once again we ask, "Why have a fuel equation at all?"

Coordinated Associations

Tentative programs for the meeting at the Hotel Sherman, Chicago, on September 4, 5 and 6—Allied Railway Supply Association to hold exhibit

Joint Meetings of Coordinated Associations

Wednesday, September 4, 10:00 A. M.

Invocation .... Opening Ceremonies
Address .... R. P. Roesch, chairman
Address .... W. G. Vollmer, president, Texas & Pacific

Thursday, September 5, 11:00 A. M.

Training Personnel in the Railroad Industry—F. K. Mitchell, general superintendent motive power and rolling stock, New York Central. This is a committee report of the Locomotive Maintenance Officers' Association to be presented at a meeting which will be attended by the members of all the associations.

Thursday, September 5, 12:30 P. M.

Luncheon in honor of John M. Hall, director, Bureau of Locomotive Inspection, Interstate Commerce Commission.

Railway Fuel and Traveling Engineers Association

Wednesday, September 4

10:00 A.M. Joint meeting of Coordinated Associations

11:00 A.M. Address: L. E. Dix, president

Report: Air Brakes—Passenger Train Handling—F. C. Goble, chairman

2:00 P.M. Viewing Exhibit

Thursday, September 5

9:00 A.M. Report: Front Ends, Grates, Ashpans, Arches—J. R. Jackson, chairman

Address: H. H. Urbach, mechanical assistant to vice president, Chicago, Burlington and Quincy

Report: Utilization of Locomotives — A. A. Raymond, chairman

2:00 P.M. Address: Air Brakes—C. D. Stewart, vice-president, Westinghouse Air Brake Company

Address: The Road Foreman and the Education of Engineers and Fireman—Theo Olson, superintendent motive power, Chicago Great Western

Address: Diesel Locomotives — O. L. Olsen, Electro-Motive Division, General Motors Corporation

Report: The Road Foreman and the Diesel Locomotive—W. D. Quarles, chairman

Report: Locomotive Firing Practice (Oil)—Frank Kurz, chairman

Friday, September 6

9:00 A.M. Report: Locomotive Firing Practice (Coal)—W. C. Shove, chairman

Report: Smoke and Its Elimination—G. B. Curtis, chairman

Report: Coal—S. A. Dickson, chairman

Address: Petroleum Products—A. L. Brodie, The Texas Company

Address: The Coal Situation—R. L. Ireland, Jr., Hanna Coal Company

Address: The Coal-Burning Gas-Turbine Locomotive—J. I. Yellott, Bituminous Coal Research, Inc.

Car Department Officers' Association

Wednesday, September 4

10:00 A.M.	Joint meeting of Coordinated Associations	
11:00 A.M.	Address:	F. E. Cheshire, president
2:00 P.M.	Viewing Exhibit	

Thursday, September 5

9:00 A.M.	Report:	Interchange and Billing for Car Repairs—C. A. Erickson, chairman
	Report:	A.A.R. Loading Rules—T. S. Cheadle, chairman
2:00 P.M.	Report:	Car Lubrication Practices — K. H. Carpenter, chairman
	Report:	Centralized Wheel Shop, Layout and Operation—L. Topp, chairman

Friday, September 6

9:00 A.M.	Report:	Conventional Passenger Car—Its Future Maintenance — W. C. Barrer, chairman
	Report:	Car Department Automotive Equipment—Selection, Use & Maintenance C. C. Cowden, chairman
	Report:	Painting of Freight Cars — R. B. Batchelor, chairman
2:00 P.M.	Report:	Light Repair Tracks—Layout, Equipment and Operation — B. J. Huff, chairman
	Election of Officers	

Locomotive Maintenance Officers' Association

Wednesday, September 4

10:00 A.M.	Joint meeting of Coordinated Associations	
2:00 P.M.	Viewing Exhibit	

Thursday, September 5

9:00 A.M.	Report:	Lubrication—J. R. Brooks, chairman
10:00 A.M.	Report:	Safety—W. H. Roberts, chairman
2:00 P.M.	Report:	Welding—G. E. Bennett, chairman
3:00 P.M.	Report:	Diesel Maintenance — T. T. Blickle, chairman

Friday, September 6

9:00 A.M.	Report:	Forging and Heat Treating—W. H. Ohuesorge, chairman
10:00 A.M.	Report:	Shop Tools—E. A. Greame, chairman
11:00 A.M.	Report:	Maintenance of No. 8-ET Air Brake Equipment—J. W. Hawthorne, chairman

Master Boiler Makers' Association

Wednesday, September 4

10:00 A.M.	Joint meeting of Coordinated Associations	
11:00 A.M.	Address:	Myron C. France, president
	Address:	T. F. Powers, assistant to vice president, mechanical, Chicago & Northwestern
	Message:	A. F. Stiglmeier, secretary-treasurer
2:00 P.M.	Viewing Exhibit	

Thursday, September 5

9:20 A.M.	Paper:	Steam Locomotives—A. J. Townsend, vice president, Lima Locomotive Works
10:00 A.M.	Report:	Post-War Locomotive Boilers—X-Ray Development—E. H. Heidel, chairman
2:05 P.M.	Address:	A. G. Hoppe, general superintendent car and locomotive departments, Chicago, Milwaukee, St. Paul & Pacific
2:15 P.M.	Paper:	Welding of Alloy Steel Plates in All-Welded Boilers — H. L. Miller, Republic Steel Corporation
3:00 P.M.	Report:	Water Treatment and Locomotive Boilers—John F. Powers, chairman
3:30 P.M.	Report:	Cinder Cutting, Slagging, Cleaning Tubes and Flues—E. H. Gilley, chairman

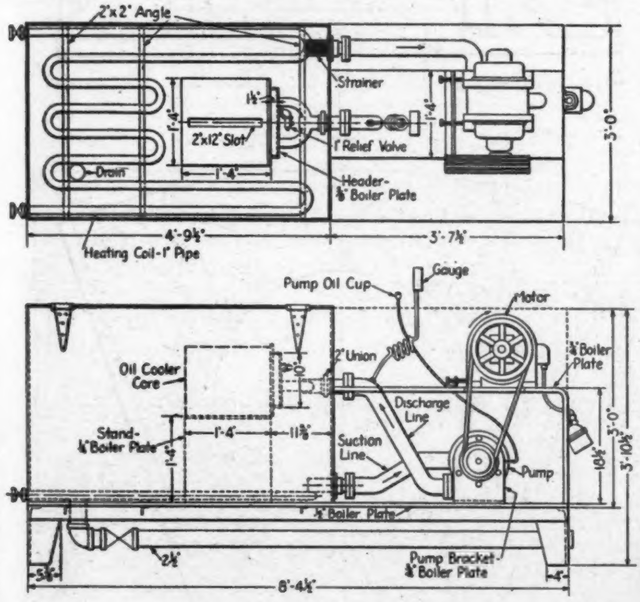
Friday, September 6

9:10 A.M.	Address:	E. R. Battley, chief motive power and car equipment, Canadian National
9:30 A.M.	Report:	Staybolts — S. F. Christopherson, chairman
10:30 A.M.	Report:	Flues and Tubes — R. W. Barrett, chairman
11:30 A.M.	Report:	Memorials—H. C. Haviland, chairman
2:00 P.M.	Business Meeting	

IN THE BACK SHOP AND ENGINEHOUSE

Cleaning Diesel Oil-Cooler Cores

Tests performed by the Southern at its Pegram shops, Atlanta, Ga., indicated that the oil coolers from its Electro-Motive Diesel-electric locomotives were not being cleaned efficiently when in the shop for maintenance. Although the outside surfaces of the oil-cooling cores appeared clean, these cooling units failed to reduce the oil temperature during water-box tests, while a cooling unit new from the manufacturer produced a rapid drop in oil



The plan and elevation of the cleaning unit

temperature. With these results as a guide, the Southern developed equipment to eliminate this source of potential trouble in its Diesel operations.

The old method for "cleaning" oil cooling cores was to soak them in a cleaning solution, blow them out with steam, and flush with hot water. The new method is to force hot cleaning solution under pressure through the cooling core and then to circulate clean hot water through the unit. The solution is forced through in the reverse direction to that of the oil flow through the cooler when the unit is in service. This procedure is used because any large particles or obstructions lodged in the core will be expelled out of the core in the direction from which they entered and not forced through under pressure, thus damaging the equipment. The essential parts of the equipment, as shown in the illustrations, consist of a centrifugal pump, an electric motor, heating coils, a tank and the connecting pipes.

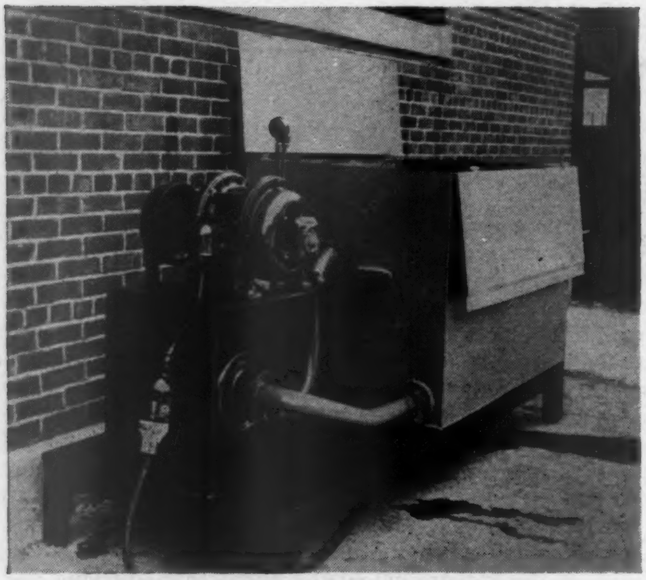
The cleaning solution, heated by the steam coil in the bottom of the tank, is drawn through the suction line by an Electro-Motive water pump of the type used in Model 567 and 567A Diesel-engine cooling systems from which the spur drive gear has been removed. It is forced through the discharge line at a maximum pressure of 40 lb. per sq. in., the relief-valve setting. A 5-hp. motor, operating on a three-phase, 220-volt power source at 1,150 r.p.m., drives the pump through vee-belts at a speed of 2,012 r.p.m. The motor and pump sheaves are 10½ in. and 6 in. in diameter, respectively.

The pump suction line is made of 3-in. copper pipe with a tubular wire strainer located at the intake opening at the bottom of the tank. The discharge line is of 3-in. copper pipe reduced to 2-in. pipe at the top flanged connection and then to 1¼-in. pipes for the two branch lines entering the header. The steam heating coils are of 1-in. pipe. A 2½-in. line is used to drain the solution from the tank.

A box cover of jacket iron completely encloses the motor and pump when the unit is in operation, the cover being in the background of the photograph showing the inside of the tank. Hinged covers on the tank, when closed, eliminate any splashing of the hot solution on workmen or on the floor and other equipment.

The procedure used by the Southern in cleaning the cooler cores is to set a core on the stand and clamp it to the header. The tank is then filled to a depth of approximately 12 inches with a cleaning solution. Good results are obtained at the Pegram shops by a solution composed of Oakite Penetrant, 10 ounces to the gallon of water, or Oakite No. 9, three gallons to 100 gallons of water. After the solution is heated the pump is started and the liquid circulated through the core for a time varying between 45 minutes and one hour. A method of telling whether the core is cleaned or not is by comparing the pressure in the pump delivery line with the pressure produced with a new cooling core on the stand as a standard.

Cleaning solution being forced through the oil-cooler core



The cleaning unit with cover removed from motor and pump

After cleaning the cooling cores with the solution, the tank is emptied, filled with water, and clear hot water is forced through the cores for rinsing purposes. For this reason the cores are usually cleaned in groups, whenever possible, to save the waste of cleaning compounds which would occur if one core was cleaned at a time. Also, when cleaned in groups, two cores can be soaking in the solution while one is being washed on the stand.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Staybolt Stresses

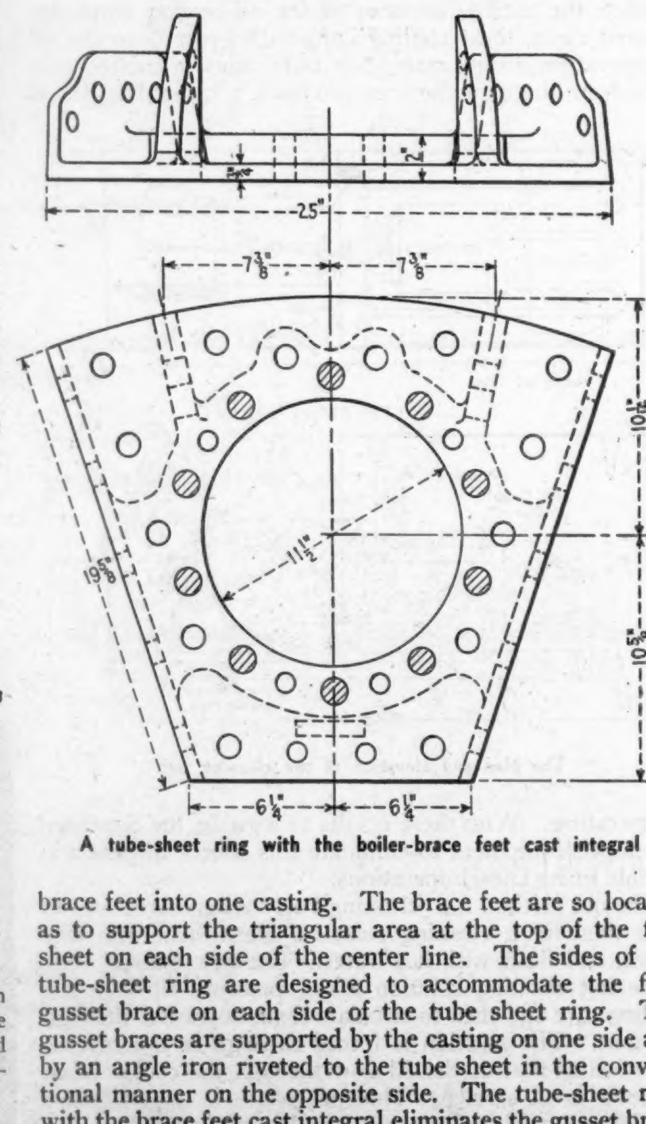
Q.—Would a staybolt arrangement which produces a maximum load of 6,000 lb. per sq. in. on the staybolts be better than one which has a maximum load of 7,500 lb. per sq. in. as provided for in Rule 3 of the Locomotive Boiler Inspection Law?—D. A. K.

A.—It is preferable to use the arrangement which would bring the stress in the stay due to boiler pressure as near to the maximum allowable limit of 7,500 lb. per sq. in. as possible. In order to obtain a lower stress on the staybolts than the maximum allowable limit, either the spacing of the stays has been reduced or the diameter of the stay used is larger than is required. In either case the construction is made more rigid than necessary which is an undesirable condition considering that the life of the firebox sheets and staybolts depends largely upon the flexibility of the construction. The recommended practice is to limit the diameter of staybolts in all locations where the water space is 10 inches or less to 7/8-in. diameter for both straight rigid and reduced-body stays and to limit the spacing of the staybolt to yield a gross unsupported area not to exceed 14.06 sq. in. which is equivalent to a 3¾-in. square.

Tube-Sheet Ring Combined with Brace Feet

Q.—In supporting the front tube-sheet area around the dry pipe, it is often impossible to obtain a good distribution of the boiler braces adequately to support the area directly adjacent to the tube-sheet ring. We have been advised that some roads combine the tube-sheet ring and boiler frace feet into one casting. Can you furnish us with a detail of such an arrangement?—M. E. R.

A.—The tube-sheet ring shown in the illustration is an example of a tube-sheet ring combined with the boiler



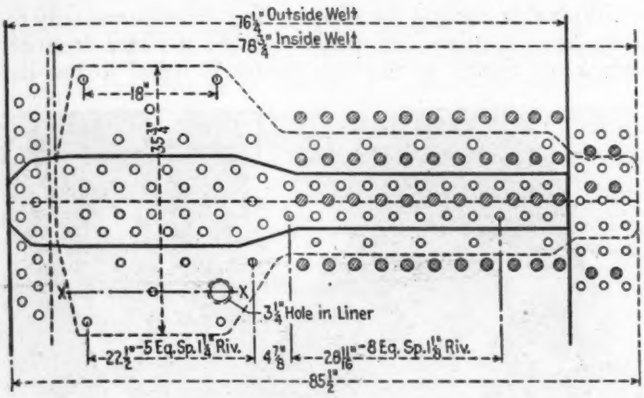
A tube-sheet ring with the boiler-brace feet cast integral

brace feet into one casting. The brace feet are so located as to support the triangular area at the top of the flue sheet on each side of the center line. The sides of the tube-sheet ring are designed to accommodate the first gusset brace on each side of the tube sheet ring. The gusset braces are supported by the casting on one side and by an angle iron riveted to the tube sheet in the conventional manner on the opposite side. The tube-sheet ring with the brace feet cast integral eliminates the gusset brace angle iron on the side adjacent to the tube-sheet ring, this making it possible to support the tube-sheet area adjacent to the tube-sheet ring in a more efficient manner.

Efficiency of Longitudinal Seam

Q.—I am enclosing a print of the longitudinal seam used on the third course of our Pacific-type locomotive boilers. The question has been raised as to what effect the 3¼-in. hole, as shown in section *X-X*, will have on the efficiency of the seam.—F. I. D.

A.—As a general rule the efficiency of a longitudinal seam is based on a unit section of the seam; a single hole that is not uniform along the seam is disregarded. In this instance, as a check, the strength of the seam could be



Design of third-course longitudinal seam

computed for the tearing of the plate along the line *X-X* plus one rivet in single shear in the outside row. Resistance to failure along the line *X-X* could be computed as follows:

$$E=\frac{\left[P-(d\ \frac{D}{2})\right]\times TS\times t+A\times S}{P\times TS\times t}$$

Where

P = Pitch of rivets on row having greatest pitch = 18 in.
d = Diameter of rivet after driving = 1.3125 in.
D = Diameter of plug hole = 3.25 in.
TS = Tensile strength of plate = 55,000 lb. per sq. in.
t = Assumed thickness of plate = .875 in.
A = Cross-sectional area of rivet after driving = 1.353 sq. in.
S = Shearing strength of rivet in single shear = 44,000 lb. per sq. in.
E = Efficiency in per cent.

Substituting, we have

$$E=\frac{18-(1.3125+\frac{3.25}{2})\times 55{,}000\times .875+1.353\times 44{,}000}{18\times 55{,}000\times .875}$$

$$E=\frac{15.0625\times 55{,}000\times .875+1.353\times 44{,}000}{18\times 55{,}000\times .875}$$

$$E=\frac{724{,}882+59{,}532}{866{,}250}=50.5 \text{ per cent}$$

In the regular computation of a quintuple riveted butt joint, the efficiency through section X-X would not be considered.

Locating Drop Pipe For Low-Water Alarm

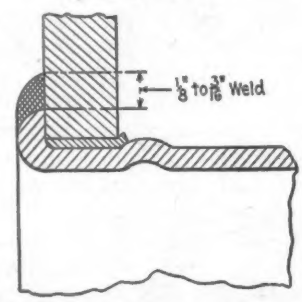
Q.—We have several locomotives coming into our terminal equipped with low-water alarms. We have instructions that the end of the drop pipe is to be one inch above the level of the bottom gauge cock. What methods are used for determining the length of the drop pipe?—R. E. F.

A.—To obtain the length of the low water alarm drop pipe the boiler should be leveled transversely and longitudinally. A gauge or leveling block is made, the top of which is straight and the bottom conforming to the transverse contour of the crown sheet at its highest point. The gauge is made from 24 to 30 in. long and is laid out so the center of the gauge corresponds with the vertical center line of the boiler at the highest point of the crown sheet. The height of the gauge or leveling block at the center is made equal to the distance that the bottom gauge cock is above the highest point of the crown sheet plus one inch. The gauge or leveling block is set on top of the crown sheet at its highest point and the top of the gauge leveled transversely, care being taken to avoid rivet heads. The top of the gauge is then the correct height above the top of the crown sheet for determining the length of the drop pipe. A low-water alarm drop pipe of sufficient length with a ring gauge applied is set in place. Next, a straight edge of sufficient length is placed on top of the gauge or leveling block and extended out to the drop pipe; the straight edge is leveled with a spirit level, and the drop pipe is marked to correspond with the top of the gauge or leveling block. The ring gauge on the pipe is immediately secured at the marking and the drop pipe removed, cut off at the ring gauge, and reapplied.

Seal Welding of Combustion Tubes

Q.—I would appreciate information on how to eliminate the trouble we have in keeping combustion tubes tight in the firebox. The tubes are applied in the conventional manner, beaded over on the wrapper sheet, expanded and beaded over on the firebox side, using No. 15 B.W.G. copper ferrules.—F. I. B.

A.—The general practice is to seal weld the firebox of all combustion tubes as shown in the illustration. On some railroads the combustion tubes are fastened to the wrapper sheet in the conventional manner while in the firebox sheet the tube hole is flared. The tube is then rolled into the flared hole and seal welded, thus eliminating the copper ferrule which is the source of most of the trouble.



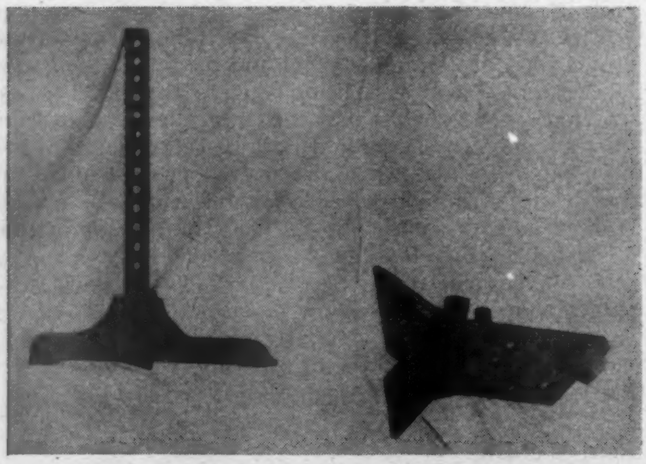
Seal weld at firebox end of combustion tube

Shop Devices

Tramming of Locomotive Main Rods

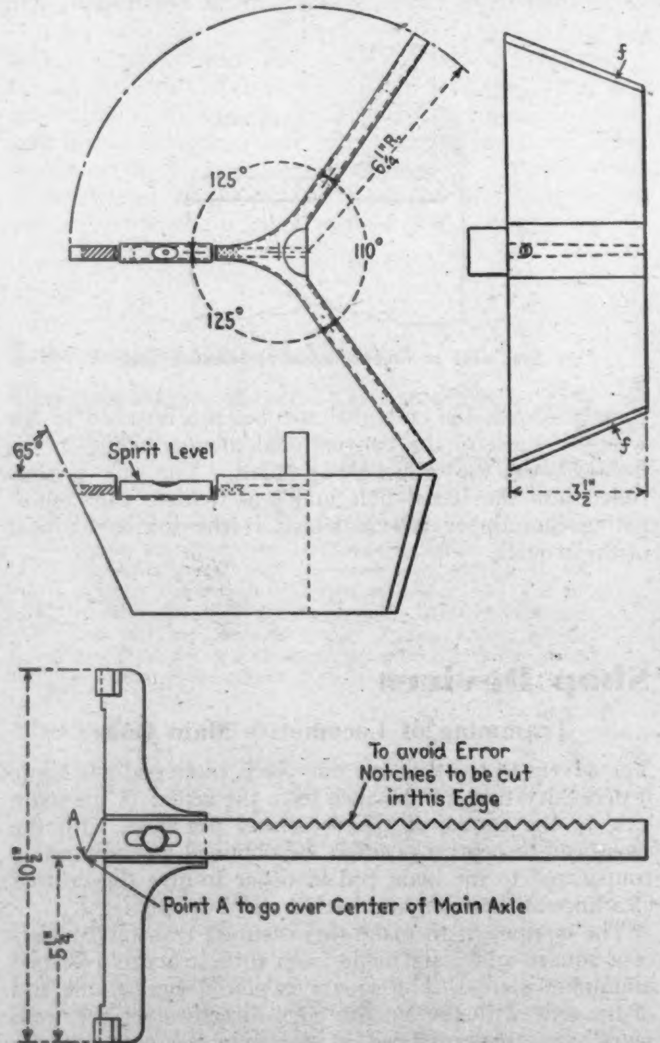
The advent of the solid, or one-piece, main rod has made it necessary that the distance from the center of the main axle to the center of the crosshead pin hole, with the crosshead in central position. be obtained and accurately transferred to the main rod in order to give the desired clearance at the front and back ends of the piston.

The equipment to make this accurate transfer consists of a square and a jig made from three trapezoid-shaped aluminum plates. The square is placed against the end of the axle with the smooth edge directly over the tram mark, and the crosshead is placed in the center of its travel. One end of the wooden stick is held horizontally against the smooth edge of the blade of the square; the other end is inserted through the crosshead. With the stick held against the pin holes lines are scribed on the stick at the front and back sides of the pin holes. The distance from the center between these two lines to the end of the stick is the proper length between bearing centers for the main rod.



Square and jig for obtaining bearing-center distance on the main rod

To transfer this length to the main rod the jig is placed in the hole at the back of the rod. As the jig is self-centering, this step determines the center of the hole. Put two center-punch marks on the front-end brass by using



Equipment details for tramming solid main rods—Upper: Self-centering device for locating center of main-rod back bushing—Lower: Square for locating axle center

a square to transfer the two lines down from the wooden stick. Boring between these marks will result in a main rod with correct center-to-center distance between brasses.

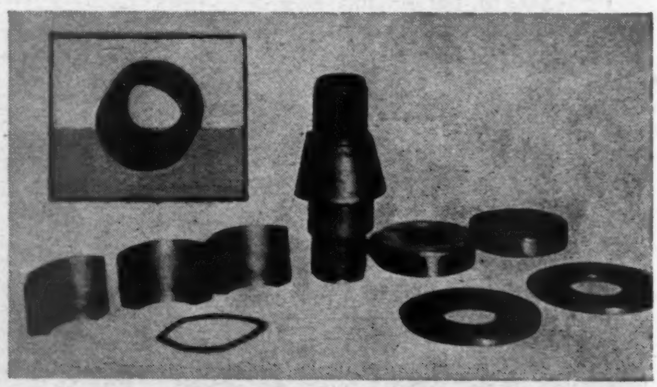
With this method for transferring dimensions, only the crosshead requires centering. As the distance from the crank-pin center to the axle center is equal to one-half

Self-centering-jig in place on the main rod

the length of crosshead travel, the distance from the center of crosshead travel to the center of the axle is the exact length for the distance between bearing centers of the main rod.

Dummy Pin for Crosshead

The amount of lead when the piston is at either extremity of its stroke can be determined without performing the heavy work frequently connected with placing the



Principal parts of dummy crosshead pin with insert showing bushing assembled

crosshead pin in the crosshead. The union link can be connected to the combination lever and the crosshead moved back and forth by substituting a dummy pin for the regular pin, thereby eliminating the necessity of lifting the heavier pin and the possibility of having to jump the wheels with a bar.

The dummy pin consists of three main parts: the body, threaded on both ends, the collars with internal threads, and a three-segment bushing. The taper of the bushing matches that of the tapered portion of the body. The bushing is circumferentially grooved on the outside, and the three sections of it are held together by a 3/16-in. coiled spring fitting around the groove. This expanding feature enables the dummy to fit a wide range of hole sizes.

The false crosshead pin is easily assembled and inserted. It fits only in the outside hole of the crosshead, is light,

and gives a good connection for the back end of the union link. The use of this dummy makes it possible to check and set the lead before the engine is wheeled or the main rods done.

Air Brake Questions and Answers

The 24-RL Brake Equipment for Diesel-Electric Locomotives

PARTS OF THE EQUIPMENT—LOCOMOTIVE A UNIT

457—*Q.—What is located on the service application portion?* A.—A service application portion on which is located the service application piston to provide an automatic service brake application in case the safety control feature operates. Also, the cut off valve which cuts off the supply to the brake pipe and equalizing reservoir when the application portion is in the application position.

458—*Q.—What does the filling piece portion consist of?* A.—A filling piece portion, on which are located the first service cock for cutting out the first service operation of the brake valve when desired; a double heading cock for cutting-out of the brake valve and the safety control functions on the second locomotive when double heading and the equalizing piston valve portion for reducing brake pipe pressure at the proper rate regardless of train length (with brake valve in service position).

459—*Q.—What does this provide?* A.—It provides a relatively uniform reduction of brake pipe pressure through a long train with maximum permissible brake pipe leakage (with the brake valve in first service position).

460—*Q.—What is connected to the pipe bracket portion?* A.—All pipe connections are made to this portion permitting the removal and replacement of any of the other brake valve portions without disturbing the piping. To this portion is also attached the feed valve for maintaining a predetermined normal air pressure in the brake system.

461—*Q.—What type is the* S-40-D *independent brake valve?* A.—A self-lapping brake valve which provides for the independent application and release of the locomotive brake.

462—*Q.—What does the combined equalizing and reduction limiting reservoir provide for?* A.—The equalizing reservoir provides for operating volume sufficient to stabilize the equalizing piston operation. The reduction limiting reservoir provides a volume into which the equalizing reservoir equalizes at the service rate at the beginning of a brake application in the first service position of the brake valve. Also, during a safety control application it serves as a first reduction reservoir if the rotair valve is set for long train operation and as part of the total reduction limiting reservoir volume if set for passenger service.

463—*Q.—What is the purpose of the second reduction reservoir?* A.—A second reduction reservoir, added to the first reduction reservoir, limits the brake pipe reduction to that required to obtain a full service brake application during a safety control application, providing the brake valve handle is moved to lap position when the application is initiated.

464—*Q.—What is the function of the first suppression reservoir?* A.—This reservoir is connected to the face of the split reduction timing valve diaphragm for the purpose of holding the split reduction check valve closed and providing a time interval between the first and second reduction of a split reduction of equalizing reservoir pressure during a safety control application.

465—*Q.—What is the purpose of the controlled emergency portion?* A.—It controls the rate of locomotive brake cylinder pressure build-up during emergency applications.

466—*Q.—How is this set up?* A.—It is set up manually by the position of the K-2 rotair valve to provide for a controlled rate of emergency brake cylinder build up on long freight trains and non-controlled emergency brake cylinder build up on short freight or passenger trains.

467—*Q.—What is the purpose of the* K-2 *rotair valve?* A.—To set up the brake equipment for a short train or for passenger service (a) non-controlled emergency or, (b) straightaway safety control application. For long freight train service, (a) controlled emergency, (b) split reduction safety control application, and (c) lap position on the non-operating end of a multiple unit engine or dead engine to prevent independent brake valve operation.

468—*Q.—What does the* D-24 *control valve automatically control?* A.—The D-24 control valve automatically controls the B-3 relay valve which in turn controls the flow of air from the main reservoirs to the locomotive brake cylinders when applying the brakes; from the brake cylinders to atmosphere when releasing the brakes, and automatically maintains locomotive brake cylinder pressure against leakage when holding the brakes applied.

469—*Q.—What other functions does it perform?* A. It performs other functions such as emergency sanding or emergency power cut-off and emergency transmission in emergency application, accelerated release after emergency and main reservoir charging on a locomotive handled dead in a train.

470—*Q.—What does the* B-3 *relay valve do?* A.—It relays the application and release operation of the control valve.

471—*Q.—What does it reproduce?* A.—It reproduces in the brake cylinders, the equivalent air pressure established in the displacement reservoir.

472—*Q.—Why are the auxiliary, emergency and displacement reservoir combined in one structure?* A.—In order to conserve space and keep the weight as low as possible.

473—*Q.—What does the auxiliary reservoir provide?* A.—The air supply for the proper functioning of the control valve service portion.

474—*Q.—What does the emergency reservoir provide?* A.—The emergency reservoir air is used to provide the quick recharge and high emergency pressure features.

475—*Q.—What does the displacement reservoir provide?* A.—The required operation volume to the relay valve to develop the proper brake cylinder pressure for a given brake pipe reduction so that the braking force developed on the locomotive is uniform with that on the cars of the train.

476—*Q.—What is the purpose of the main reservoir cut-off valve?* A.—To protect against loss of main reservoir air in case of a broken main reservoir pipe.

477—*Q.—How much main reservoir pressure will be retained?* A.—Approximately 85 lb. air pressure will be retained in the main reservoirs by the cut-off valve for braking purposes, if the main reservoir pipe between the locomotive units is broken.

478—*Q.—The two air filters are so located to protect which devices?* A.—The one in the main reservoir pipe is for protection of the automatic and independent devices, and the other is for the protection of the control valve and relay valve.

With the Car Foremen and Inspectors

A Future for

The Standard Journal Box?*

By L. D. Grisbaum †

Are the precision and close tolerances of roller-bearing dimensions applicable to the standard waste-packed journal-box assembly? The author believes the answer to be yes. His reasons are challenging

THE journal-box assembly is one of the important items coming under A. A. R. Mechanical Division Standards and Rules. There is no single mechanical part on the entire railroad that has received more official talk; certainly among mechanical men it has been the leading competitor of the weather as a subject for conversation and discussion. It is an interesting fact, however, that the mechanical improvements to the assembly down the years have been minor. Is this because the strict standards and rules of the A. A. R. has stopped development? Or is it because the basic idea of the assembly is so good that it cannot be improved? Any mechanical design to be continued without essential change during this long period of railroad history has to be good. The further we get, in an endeavor to improve its design without interfering with interchangeability, the more respect we must have for the earlier generations who were responsible for the waste-packed journal-box assembly.

It is my opinion that the conventional journal box assembly has become static partially because standardization is a formidable bulwark against change, and partly because of the high operating efficiency of the assembly. Considering standardization, under the A. A. R. rules periodical inspection of the journal-box parts and renewal of bearings and other parts is provided for. Standard parts are stored at all repair points throughout the country. The work is performed by handling line and owner billed through the A. A. R. at a fixed unit price.

The railroad mechanical forces at car repair and servicing points have evolved through the years and are established under labor agreements that cannot be readily changed. These forces are not necessarily schooled in handling precision mechanical work, but are experienced and efficient in handling the relatively rough operations of repairs and maintenance of the conventional journal-box assemblies. The present A. A. R. standard journal bearing and associated parts in service and in stock throughout the country represents a very large investment in material. If the journal bearing were changed to the extent that the related parts of the box assembly required alterations or changes, this would constitute a costly major operation and result in considerable confusion during the transition period.

For the above reasons, any change in the design of the highly standardized journal-box assembly pointing towards improving its performance must be analyzed carefully from both a practical and economic standpoint.

Standard Bearings Reliable

The overall performance of the railroads in handling the unprecedented volume of business during the war emergency has been accomplished with a remarkably low rate of train delays attributed to the design of the present car journal bearing under freight and passenger equipment in interchange service. General performance of the conventional journal bearing has been satisfactory and, aside from the economic consideration, there does not appear to be an urgent necessity for changes in its design or construction. Therefore, despite the importance of the bearing and the great number replaced annually, little effort has been made to improve its performance.

If the failures responsible for train delays during any period are considered in relation to the number of journal days in that period, the efficiency of the assembly is better than 99.9 per cent. Regardless of its efficiency, however, the bearing and assembly is fortunately susceptible to improvement. If the 125,694 car set-outs due to bearing trouble in freight cars in 1945 with the resultant loss of time, service, and revenue is not a sufficient reason for improving the setup, certainly there is an economic necessity for change to the assembly that required approximately 6,000,000 bearings to produce the 36,997,000,000 freight car miles in 1945 with a life in round figures of 6,000 car miles per bearing applied. When we consider that the babbitt lining is consumed at the rate of about one thousandth of an inch per 1,000 bearing miles after the initial wearing-in or wiping-in period, and starting with ¼ in. lining at the crown, it would be reasonable to expect better than 200,000 miles per bearing. However, at the end of their average life bearings are removed for one of many reasons but seldom because of crown wear since only three in every 100 bearings removed are worn out at the crown.

Economic Improvement Needed

It is my opinion that in spite of the well established standardized procedure of the A. A. R. and the operating

* Paper presented at the May, 1946, meeting of the Car Foremen's Association of Chicago.

† Railway Service and Supply Corporation, Indianapolis, Ind.

efficiency of the journal-box assembly, there is now an urgent economic need to improve the bearing and the related parts of a journal box; to review and modify rule 66 where necessary to accomplish a big reduction in condemnable parts under the rule and to reduce the number of bearings that are scrapped outside the rule, such as wheel-change bearings; and to insist on better material and manufacturing practices in order to reduce the too large percentage of bearing removals contributed by manufacturing defects. This leads us to the question as to what direction we can take to improve the present journal-box assembly set-up.

It would appear that the greatest possibility for immediate improvement of the conventional assembly is in the direction of better workmanship in finish and in the assembly of the essential parts in order that the dimension and finish influence on defect and failure may be more closely controlled. The determinable factors of design responsible for the natural limits of the life of the assembly are the proper materials for the loads and speeds and the proper conformity of the parts. I am not so much concerned with these engineering factors because they have been proved adequate as witness the high operating efficiency in spite of the abuses.

There are, however, a great many different factors that influence the operational life obtained from the bearing. Among these may be included inadequate or incorrect lubrication which covers the entire subject from improper oil and waste through poor renovation and preparation of packing to wrong practices of application and servicing. Among these factors are excess wear caused by abrasives that enter the box through inadequate box closures; faulty dimensions of bearing and wedge due to manufacturing and running tolerances on the too liberal side; lack of adequate machining of the bearing and arts; external violence; and many others of like incidental nature that are avoidable and are, therefore, not subject to any law capable of being reduced to mathematical expressions. Under normal times the degree to which a railroad has corrected the incidental factors of journal performance can be weighed in the operating records and measured by their cost records of both direct and indirect lubrication. However, today the turnover of equipment on line is so rapid and such a relatively few home cars are seen on the owner's line that the necessity for adequate universal practices becomes most apparent.

There are some who see the present waste-packed standard bearing assembly in freight service replaced by roller bearings, and a new freight truck incorporating roller bearings is now being road tested. Personally, I am convinced that the possibilities of improving the A. A. R. journal-box assembly has not been seriously explored and those developments already available have not been adequately tested under official sanction. My impressions are that great advances are possible through design, workmanship, and material which would provide an assembly that would make the change to roller bearings a very questionable economic procedure. Truly the roller bearing does not present the service problem to the car men that he encounters with the present waste-packed box.

Closer Fits Between Parts

I do not believe, however, that the variation in the service requirements between the two bearings is due in a large measure to fundamental differences of design, but because by the very nature of the roller bearing the manufacturer has taken every advantage to eliminate from his setup all causes for incidental failures that are responsible for the service demands of the standard setup. The roller bearing is manufactured or assembled in its entirety by the supplying company and he measures his tolerances in thousandths or even tenths. He further insists on strict dimensional adherence in truck, wheel and axle specifications to assure proper performance.

Contrast this to the universal procedure with the standard bearing where the railroads buy a bearing from one manufacturer, the wedge from another, and the box from still another, etc.; all of these parts being rough cast with a minimum of machining and all with a very liberal manufacturer's tolerance and a more generous operating tolerance. In fact, the difference at present between opposite box assemblies on the same axle can be measured in fractions or even inches. Illustrating this, the lining of a 5½-in. by 10-in. bearing is either rough cast or broached to 5$\frac{9}{16}$-in. diameter. The corresponding journal diameter can vary from 5½ in. when new to 5 in. before axle is condemned in road service. Therefore, a 5$\frac{9}{16}$-in. bearing is applied to a journal with a permissible diametral running clearance from $\frac{1}{16}$ in. to $\frac{9}{16}$ in. The length of the journal, likewise, may vary from 10 in. for a new axle to 10½ in. shop limit and 10⅝ in. road service limit. We can conceivably be close to condemning limits on one side of the axle and approximately nominal on the other end in which event the wheels could not possibly track, the bearing crown would be diagonal to the center line, and the lateral thrust in both directions would be taken on the same side of the axle.

For a long time I have been convinced that a journal assembly could be put together with standard parts all properly machined to nominal dimensions and with an adequate finish on all contact and wear surfaces so that, when this assembly is applied to a properly finished journal and the box packed with a high-grade sponging protected by tight box closures, a trouble free operation with a minimum of servicing would result. This suggested the idea of a single company taking the responsibility for furnishing the complete box assembly with all the mechanical parts finished to nominal dimensions and all made to limit gages in order to insure continuity of conformity when replacements are necessary. We have finished and fitted the principal parts of journal-box assemblies in our shop which are operating in both passenger train cars and locomotives with results that have far exceeded our expectations. They have completely confirmed the contention that, with the exception of accidental failures that cannot be controlled, there is no reason why, with the present journal box assembly refined and more accurately finished, it is not possible to eliminate or at least control the defects and failures that occur by the thousands for reasons that we all know but which are not corrected.

After a quarter century of intimate contact with the practical and technical problems of journal operation and lubrication, I sometimes wonder whether the railroads will ever become sufficiently dissatisfied with the static condition of such an important part of their plant that a specification of performance will be prepared and insisted upon to replace the specification of design under which all parts must now be finished. If you men charged with the maintenance and operation of cars were given the responsibility of defining exactly what you would consider an adequate performance in the operation of a car journal as it affects maintenance, service requirements, life of parts, etc., and the railroad would demand as a minimum that performance specification, then I believe the conventional journal box assembly would be improved and developed to a degree where it would become competitively comtemporary with the roller bearing. It already has the decided advantage of

weight and price over the roller bearing. to say nothing of the other established facts mentioned elsewhere in this paper. If, however, we are going to continue with practices and designs used twenty-five years ago, have we the right to expect anything better than the performance records of the time?

One current illustration is the question as to whether the emergency bearing or the pre-war bearing is to become the A. A. R. standard. This question is being investigated once again by the bearing development committee for a report and recommendation to the general mechanical committee. The emergency bearing was so named because its light weight resulted in the saving of strategic metals during the emergency. It is the writer's opinion, however, that the superior design of the bearing was responsible for a far greater saving in metals by its better performance and fewer defects than its lighter weight could possibly save.

The dimensional changes to the pre-war bearing that the war brought into general use in the emergency bearing was the result of a careful study into the causes for and the possible remedies that could be readily applied to overcome condemnable defects under rule 66 that was responsible for a large percentage of bearing removals. The principal changes that distinguish the new from the old bearing were carefully considered and recommended by Committee 5 of the Car Department Officers' Association. This recommendation was successfully acted upon by the association and is reported in its 1940 proceedings. Although the weight of the bearing was the reason for its use in interchange equipment during the war, it was not a consideration in the acceptance of the bearing by the Car Department Officers' Association, but rather because the changes recommended resulted in a considerable overall improvement in bearing performance.

In 1935 we constructed a full size functional model of a complete axle assembly in order to ascertain, if possible, the effects of lateral and variable tolerances of the respective parts of the journal box. It was impossible to visualize the thousands of conditions that could exist in one axle assembly by changing the many and sundry permissible variables in the parts. Three basic changes in the dimensions of the journal very soon suggested themselves. First, it was observed that in either direction of lateral with a nominal dimensioned assembly the journal could move ¼ in. in one direction and $\frac{5}{16}$ in. in the other. This means that in every new assembly $\frac{1}{16}$ in. of end wear at the collar had to be taken before the fillet end of the assembly could function as a thrust member. The obvious correction for this was to increase the thickness of the collar lug on the bearing by $\frac{1}{16}$ in., as the differential in lateral was the $\frac{1}{16}$ in. clearance between the wedge and the bearing collar when all parts of the box were on center. This not only stabilized the lateral, but had the additional advantage of strengthening the collar lug, reducing the shock load on the collar, and decreasing the movement of the wedge in the box.

Second, it was observed the *C* dimension or overall width of the wedge and bearing were identical with each other and had a generous plus or minus tolerance. In many cases, therefore, the bearing was wider than the wedge which resulted in the bearing rather than the wedge taking the side thrust on the post or side lug of the box. This resulted in a large number of bearings being removed on account of spread linings. The corrective measure was to reduce the *C* dimension by taking some of the excessive metal from the bearing rails.

Third, it was apparent that by setting the side lug of the bearing forward the collar end wear caused by axle lateral could be controlled to the extent that the lugs were moved. The effect was identical to shortening the bearing at the journal collar end but without a reduction in effective bearing area. Because any lengthening of the journal from the center line to the fillet increases lateral, and the increase in length from the center line of the journal to the collar has no effect on lateral, but has the same beneficial effect on end wear as would removal of the collar, we set up a condition that would take care of the majority of cases in passenger equipment by moving the lug forward a maximum of ¼ in.

Fourth, by utilizing the depressed-back feature in the bearing the principle of loading was changed from a single point to two points which completely changed the shape and size of the effective crown area resulting in greater safety, longer bearing life, and fewer failures.

It is to be noted that the above changes had to do with dimensional conditions that were simple and inexpensive and were effective in greatly reducing the number of condemnable bearings. The following survey involved 11,054 bearings of which 8,261 were pre-war and 2,793 were of the emergency design. The investigation disclosed 16.62 per cent of the pre-war bearings were removed for end wear while only 3.11 per cent of the emergency design were condemned for the same cause. Because the journal under the emergency bearing has ½ in. more free movement on a side than the pre-war setup before the journal collar can contact the bearing, it is apparent that end wear to some degree is a truck condition that the bearing cannot overcome.

The inspection further disclosed that 16.55 per cent of the pre-war bearings had a lining spread of ⅛ in. or more below the bottom of the brass. This compared to 0.18 per cent for the emergency bearing. While this record speaks for itself, unquestionably the 0.18 per cent indicates a small number of wedges that are considerably under the specified width.

Approximately 50 per cent of the pre-war bearings as compared to 73 per cent of the emergency bearings were not condemnable under rule 66, the removals apparently being the result of wheel changes, as the railroad making this study, require the application of new bearings on journals of the replacement wheels. By greatly reducing the number of condemnable bearings it is to be expected that a larger number of good bearings would be removed due to wheel changes. This is further evident by the fact that, out of 1,281 emergency bearings examined for the possibility of relining, 590 or 46.05 per cent were physically satisfactory, while out of 1,332 pre-war bearings, only 86 or 6.5 per cent were in physical shape for relining.

The above comparative figures are quoted in support of a bearing that is on the railroad because it was lighter in weight and, therefore, offered an opportunity to save strategic metals during the war. It should be continued in service because it is a far superior bearing to the pre-war standard, and because it is a step in the direction that must be followed if the inherent possibilities in both the efficiency and economy of the A. A. R. journal box assembly are to be realized.

We can expect a decided change in the attitude and interest of both suppliers and railroads in regard to the developments and improvements in the solid type journal bearing and assembly. There are some interesting new ideas in the process of being developed and perfected (one a flange or hood type journal box cover) that are very encouraging and should practically eliminate the natural hazard of waste-packed lubrication. However, the important first step that requires no major changes in the present functional system is to refine the conventional assembly to assure its maximum performance; and, if we do that, I predict that it will be a worthy competitor for anything that the future may develop.

The A.A.R. Price Clerks*

By T. E. Hughes†

MUCH has been said, and justly so, about the various phases of car department work, both operational and supervisory functions, which brings us eventually to that important phase—the pricing of billing repair cards. I am going to try and relate for you in the short time allotted to me some of my observations.

The billing repair card in the first place must be properly and plainly written, and should then be carefully checked by the car foreman for any omissions or errors before being forwarded to the general office for pricing. When this is not done, I will enumerate just a few of the reasons why the bill clerk finds it necessary to return the repair card to the originating point for correction or further information.

Take the case of a missing coupler or draft gear. When writing up a missing coupler, failure to show whether the car was stenciled for the type of coupler required or the type used in the opposite end makes it necessary to return the repair card. The same goes for a missing draft gear, especially so when an approved gear is applied and no information shown whether the car was equipped with a non-approved or obsolete gear.

Pipe Connections—Brakes

Pipe connections are a problem to every price clerk on every railroad, I am sure, and have cost the railroads quite a sum both from the standpoint of clerical time lost in returning the repair cards for corrections and improperly-priced repair cards. For example, take this particular case—a repair card was received covering the application of a coupling to the train-line pipe at the B-end of the car, and only one connection was shown. When this repair card is returned to show the correct number of connections, we usually receive the same answer—repair is correct as written, as it is my understanding no charge can be made for R & R of angle cock and air hose and nipple. Please advise if my understanding is correct—needless to say he is properly advised.

There is also the case where the write-up man fails to show threads cut for pipe over 12 in. in length, or if the darn pipe is single or double strength. All these things add to the headache of the price clerk, which reminds me while we are on the subject of pipe, I might make a few remarks about air brakes. A common error here is the failure to show which is defective, when the combined cylinder and reservoir are renewed. Also, when the retainer valve is renewed at the same time the air brakes are cleaned, we must show the type of retainer valve removed and whether the body was broken when renewed in kind. And last but not least, when the AB release valve is renewed, the new parts must be itemized.

Wheels—Brake Beams

Our chief worry in connection with wheels is that when wheels are renewed, we are seldom let in on the secret as to whether the wheels applied are standard to the car, or just what kind of wheels are standard to the car. In the case of multiple and one-wear steel wheels, it is often necessary to return the repair cards for information omitted, such as over-all amount of service metal, amount to be turned, or whether full-flange or non-full flange. I am sure that if each of you stopped to realize how much money is lost by your railroad on account of having to confine the charge for wheels applied to new or second-hand cast iron, through failure to show the type of wheels standard to the car, this common error would be stopped at its source.

When the No. 3 brake beam is applied, information as to the type standard to car must be shown according to stenciling on the car or the type of the majority of brake beams under the car. Failure to do this will result in confining the price of the beam applied to a No. 15 beam, whether or not you removed a No. 3. Also, when safety supports are R & R be sure and show the number of pins R & R, or renewed. Was the beam applied new or repaired and tested to A. A. R. specifications and not second-hand, for which no charge can be made?

Careful consideration should be given to Rule 17, Par.-M when applying safety supports so as not to exceed the owner's standard to avoid losses to your company.

In the case of a car given heavy repairs, seldom if ever does the repair card show that the car was light weighed on account of a variance in weight of 300 lb., or more, due to repairs which were made.

Where parts are repaired on a car, be sure and show the number of square feet painted, for which a charge can be made for labor in addition to the cost of paint. This information is often omitted.

When latitudinal running boards are repaired on both ends of a car, they must be shown separately so as to enable the price clerk to determine when he is exceeding the price of one complete latitudinal board at one end of a car.

If Schaefer bottom rods are used, be sure and so state and not show merely a bottom rod. This information must also be shown for the Schaefer hanger and state whether or not it is standard to the car.

Seldom, if ever, is the proper information shown for stock car door repairs. There always seems to be a question in the mind of the price clerk, in the absence of specific information, whether a stile, batten, or rail is applied, or if the door is of the common or reinforced type.

Roof sheets should be shown as either full or half, intermediate or end, because of difference of price.

Door wear plate bolts or screws in old boards, not renewed, should be shown for correct pricing, in addition to the charge for any new decking applied.

In the case of repair cards supported by defect cards, if the repairs are listed in the same order on each, it would save the price clerk considerable time in checking off the repairs against the defect card.

I have mentioned but a few of the most common errors in writing repair cards, and I believe these errors could be corrected at their source and considerable time and unnecessary clerical expense be saved, to the credit of the car department supervisor. Difficulties in writing billing repair cards are not, in my opinion, due to any complications in the A. A. R. rule book, but on the contrary, it is my humble opinion that we who use the rule

* Paper presented at the April 16 meeting of the Car Department Association of St. Louis.
† A. A. R. clerk for the Missouri Pacific at St. Louis, Mo.

book every day owe a debt of gratitude to the men who guide and direct the actions of the Mechanical Division of the A. A. R. for their foresight in making these rules understandable to everyone.

The errors and omissions just mentioned are in no way to be taken as a reflection on the ability of the car men of our railroad, inasmuch as these same errors are found when checking the bills of other roads.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Damage to Draft Members

On April 7, 1941, the Chicago, Milwaukee, St. Paul & Pacific delivered refrigerator car CRLX 5199 to the Sioux City Terminal Railway, the latter placing the car on the Cudahy Car Lines' rip track for temporary repairs. A claim for defect-card protection for "Two steel center sills and cover plate bent and broken between the two bolsters" was made against both of the railroads. The defect cards were not furnished because the railroads claimed they had no record of the damage while the car was in their possession. The C. M. St. P. & P., after reviewing a blueprint of the car submitted by the car owner, contended that the damaged parts were draft members as defined in Note A of Rule 44 and therefore the defects were the owner's responsibility as the car was not damaged under any of the conditions given in Rule 32.

In a decision given on November 15, 1945, the Arbitration Committee said "The construction is not classifiable as continuous metal center sills under Rule 44. The contention of the Chicago, Milwaukee, St. Paul & Pacific is sustained." *Case 1812, Cudahy Car Lines versus Chicago, Milwaukee, St. Paul and Pacific and Sioux City Terminal.*

Tank-Car Repairs Includes Leakage Test

In July, 1944, tank car SDRX 1838 was sideswiped on the tracks of the Terminal Railroad Association of St. Louis. This railroad straightened the tank sheets but did not make out a repair card or change the "tank-test" stenciling on the car. According to the Terminal Railroad no repair card was made out because only two or three hours of work were required to repair slight dents in two tank sheets and because the car had to be sent to another repair track for the completion of the repairs due to the crowded conditions existing at the original shopping point. While the tank was tested to determine that there were no leaks, the Terminal Railroad did not choose to change the stenciling. Upon arrival home the Sinclair Refining Company noted the evidence of recent sideswiping and the absence of a recent tank-test date. After executing a Joint Inspection Certificate a test was made at a pressure of 60 lb. per sq. in. as prescribed by Rule 3 which showed the tank to be leaking near the recently straightened tank sheets and further repairs were made. The Sinclair Refining Company contended that a defect card should be issued by the Terminal Railroad Association of St. Louis to cover this work because the latter made improper and incomplete repairs.

In a decision rendered on November 15, 1945, the Arbitration Committee said, "The evidence submitted shows the tank leaked in the area where the tank sheets had been straightened, when tested at a pressure of 60 lb. per sq. in., within 14 days after date of repairs. This definitely indicates the Terminal Railroad Association of St. Louis had not completely repaired the damage. The contention of the Sinclair Refining Company is sustained." *Case 1814, Terminal Railway Association of St. Louis versus Sinclair Refining Company.*

Service Test of Cotton-Insulated Car *

The initial test of the first railroad-owned cotton-insulated refrigerator car, Illinois Central No. 4790, was termed a success from results of a test run from Independence, La., to Bridgeport, Conn. A special observer, assigned by the Railway Express Agency which collaborates with the I. C. in handling the strawberry crop, reported the entire operation to be satisfactory. The temperature throughout the car was more nearly uniform than on any car that he had checked in the past.

Before beginning the trip, 9,200 lb. of ice were placed in the car at the McComb, Miss., ice dock. The car was sent to Independence where its temperature prior to loading on the afternoon of April 20 was 48 deg. F.

Illinois Central express-refrigerator car No. 4790 equipped with cotton insulation

After loading the berries the temperature had risen to 62 deg. F. and a blower was placed over each bunker with the car closed. The precooling was completed in less than three hours. The temperatures upon completion of the precooling had dropped to 40 and 42 deg. F., respectively, for the top and bottom berries.

The trip began late the night of April 20, and was completed on the afternoon of April 23. Reicing was done at Maltoon, Ill., where 756 lb. of ice and 25 lb. of salt were added. The only other icing required on the trip was at Buffalo, N. Y.

Upon arrival at Bridgeport, a representative of the Railroad Protective Inspection Service found that the fruit had stood the trip without deterioration. The customary check-up of the fruit was made by inserting a thermometer into a few of the berries; the test showed

* From information in the June, 1946, Illinois Central Magazine.

A flame test of the treated-cotton insulation

the temperatures to be 42, 39, and 36 deg. F., respectively, for the top, center, and bottom crates, or a spread of only 6 deg. throughout the car.

The application was made at the McComb car shops of the Illinois Central. Carmen applied the insulation to express-refrigeration car No. 4790 which was a standard car with typical insulation problems. Nearly 1,550 sq. ft. of surface was covered with this inslation which is treated to be flame proof, sterile, immune to rot, mold or fungus, and non-absorbent to moisture.

The cotton is in the form of batts of various thicknesses and of permanent resilience. It is further surfaced with kraft paper and aluminum foil, the latter for heat reflection and additional air and moisture protection. The amounts of treated fibers required for the car were 327 sq. ft. of 3-in. thickness, 455 sq. ft. of 1½ in. thickness, and 765 sq. ft. of 1 in. thickness. Also applied were 302 sq. ft. of special protective aluminum foil jacketing, supplementing the aluminum on the cotton batts.

The saving in weight by the new insulation is expected to be around 1½ tons per car, and improvements in heat resistance in the various car surfaces are expected to range from 25 to 50 per cent. The wearing qualities of

How the metal-foil-covered cotton insulation was applied to the car

Cotton insulation for passenger cars is being given a thorough test on the Frisco.—The insulation is reinforced with a backing of heavy waterproof paper

the insulation, and its long-time resistance to moisture and rot, can only be determined with time, but the initial test showed conclusively that the insulation qualities of cotton are excellent. The experimental car used less ice than usual for a car moving the same distance, and it maintained lower temperatures during the run.

The details of the experiment were worked out by car-building experts under Superintendent D. G. Travis at McComb, working with C. O. Young, assistant superintendent of equipment, Chicago, and D. D. Grassick, vice-president, and A. M. Andersen, a representative of the Universal Fabricated Products Company, Chicago.

THIRSTY LOCOMOTIVES.—London, Midland & Scottish locomotives are among the heaviest drinkers in the world. Their consumption of more than 9,000,000,000 gallons of water a year costs the company something like $1,250,000. To assuage this thirst without stopping the trains the L. M. S. maintains 35 water troughs along the rails at strategic points. The first such trough in the world was installed in 1859 to enable the Holyhead Royal Mail to hold to the schedule guaranteed to the Post Office.

ELECTRICAL SECTION

Locomotive Shop Lighting

Lackawanna sets a pattern for good shop illumination by revising the lighting facilities of its Scranton, Pa., shops

MATERIAL and self-evident improvements in the lighting of the Delaware, Lackawanna & Western locomotive shops at Scranton, Pa., have been effected by increasing the number of units, using improved lighting fixtures and adding a proportion of high-intensity mercury vapor units in five of six work bays. Lighting in the machine shop sections on the main floor and on the balcony at one end of the shop has been completely revised by replacing the original incandescent lights with a fluorescent lighting system. The tool room and the shop offices have also been equipped with fluorescent lighting.

Original Lighting

The west erecting bay, shown in Fig. 2, which does not now serve as a part of the shop, but is leased as storage space, is still equipped with its original lighting installation. The glare conditions are evident in the photograph, but the picture gives a somewhat better impression than it should, since one section at the far end of this bay has been equipped with new lighting.

The old lighting arrangement employed one center row of units consisting of 1,000-watt incandescent lamps in deep bowl reflectors, 50 ft. above the floor and spaced 72 ft. apart, and 200-watt lamps on the side columns, spaced 20 ft. apart and 25 ft. above the floor. These lamps were

Fig. 1 (Below)—The east heavy work bay as seen from the balcony

Fig. 2—The west erecting bay, now leased as storage space, is still equipped with the original type of lighting —Row of lens ghosts (lower center) indicate glare conditions

mounted in shallow bowl reflectors tilted at an angle of 45 deg. The distribution of light was uneven with an average intensity of less than one footcandle.

High Bay Lighting

The old lighting shown in Fig. 2 has been replaced by that shown in Fig. 1 in the four central bays and by that shown in Fig. 3 in the east erecting bay. The night photograph, Fig. 1, shows the east heavy-work bay. In this bay and in the west heavy-work bay which are each 60 ft. wide and 480 ft. long, the lights are spaced 36 ft. longitudinally and 20 ft. laterally with the units in the center row staggered with those in the two outside rows.

The two outside rows are 1,000-watt incandescent units with mill type porcelain enameled open reflectors having a screw ring reflector suspension to permit easy removal of the reflector for cleaning. The center row of lights are alternately 1,000-watt incandescent units and 400-watt high-intensity mercury vapor units. The mercury fixtures have vents and are fitted with diffusers which enclose the lamp. The bottoms of the reflectors are mounted flush with the lower edge of the roof trusses, sufficiently above the crane to facilitate cleaning and lamp removal. Mounting height is 38 ft. and horizontal illumination on the working plane is 10 footcandles, maintained.

In the two central light-work bays, which are 50 ft. instead of 60 ft. wide, the lateral spacing is 16 ft. 8 in., the longitudinal is 36 ft., the mounting height of the center row is 38 ft., and the height of the side rows was reduced to 35 ft. Lighting intensity in these bays is 12 footcandles, maintained. All of the lighting units in the four central bays are hung on girders.

The east erecting bay, Fig. 3, is lighted by a central row of 1,000-watt incandescent and 400-watt, high intensity mercury vapor units mounted alternately on 36-ft. spacing at a height of 50 ft., and by angle reflector units on the side columns. The latter consist of 750-watt lamps in standard porcelain enameled angle reflectors spaced 20 ft. apart and 25 ft. above the floor. Footcandle intensity in this bay is 15, maintained.

Fluorescent Lighting

The machine bays, one of which is shown in Fig. 5, are lighted by enameled steel industrial type fluorescent units each containing three 40-watt lamps. Longitudinal spacing is 10 ft. and lateral is 12½ ft. The units are mounted at a height of 22 ft. to clear the crane, and lighting inten-

Fig. 3—The east erecting bay is lighted by a center row of 1,000-watt incandescent and 400-watt mercury units placed alternately, and 750-watt angle reflectors on the columns

Fig. 4—A lathe in the lower machine bay showing the effectiveness of the fluorescent lighting

sity on the working plane is 15 footcandles, maintained. Units are hung on messengers which provide an easy and inexpensive means of meeting spacing and mounting height requirements. The effectiveness of the lighting in this area is indicated by the picture of the lathe, Fig. 4. All of the pictures are night photographs taken by the light from the lighting system only.

Two-lamp fluorescent units are used in the tool room where a mounting height of 12 ft. results in 20 footcandles lighting intensity.

Existing controls and wiring were used with new controls and feeders added.

Fig. 5 (Below)—The lower machine bay as it appears at night under its fluorescent lighting system

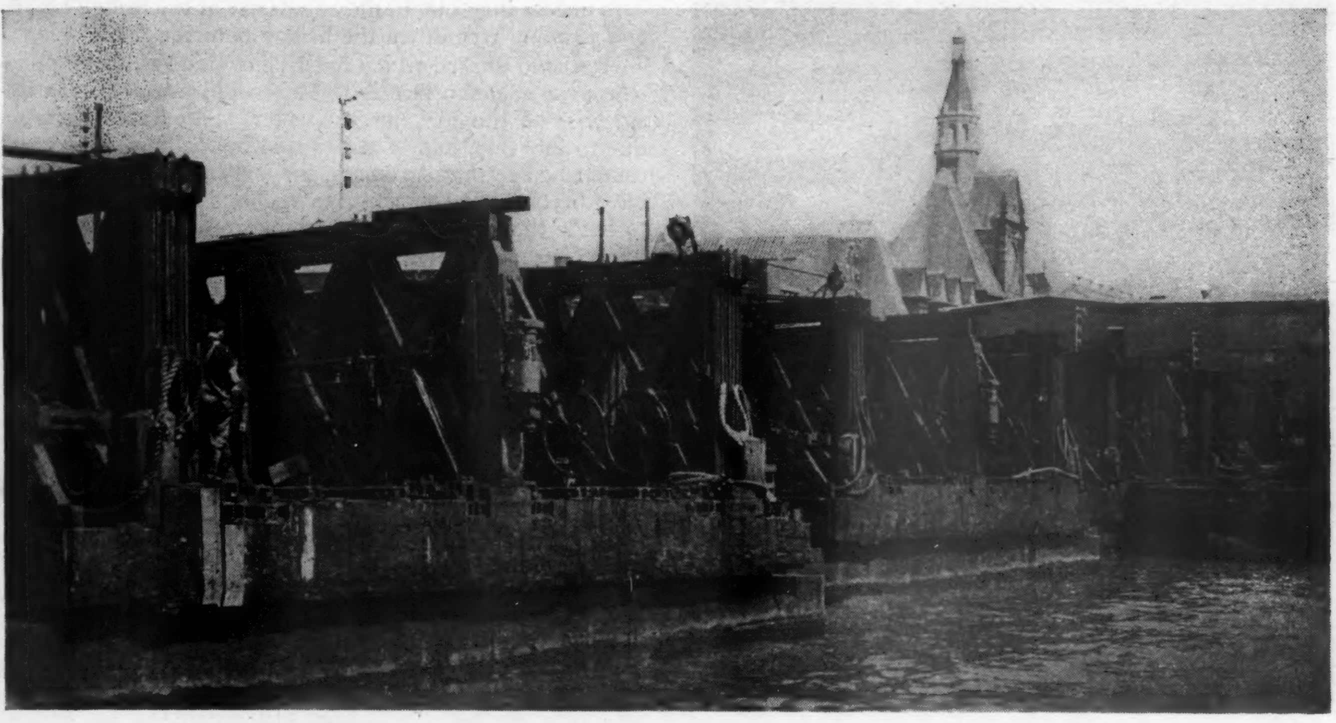
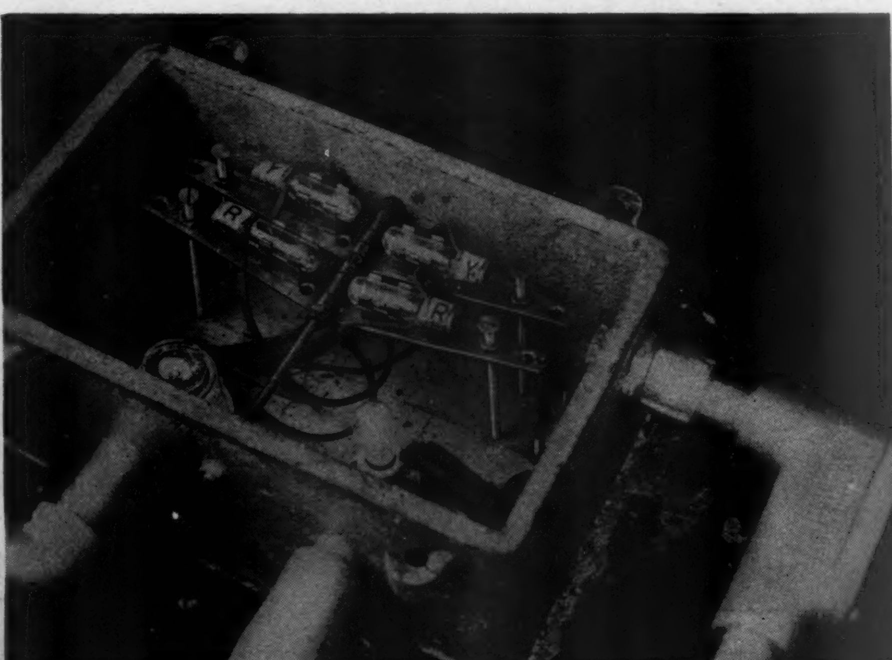


Fig. 1—Water end of the four loading bridges showing a car float secured to bridge No. 3

Safe Loading of Car Floats

Tide and tilt gauges applied to car float bridges by Jersey Central assure safe loading of cars on floats

MUCH of the freight arriving in the Jersey City, N. J., yards of the Central of New Jersey is transferred over water on car floats to various receiving points in the Port of New York area. Each of the car floats has two or three tracks on its deck and there are eight yard tracks



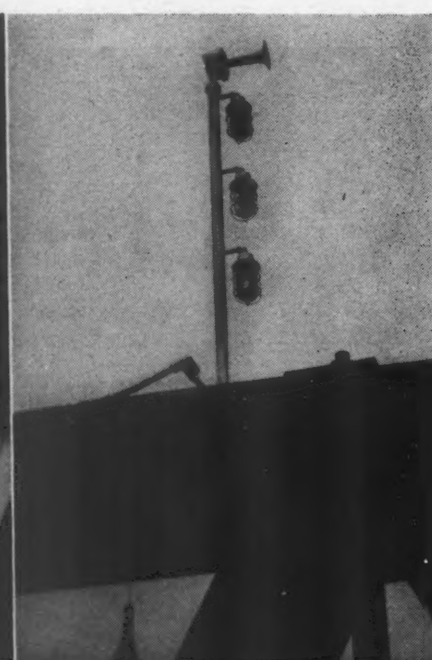


Fig. 2 (Left)—One of the lateral tilt gauges with the box cover removed—Fig. 3 (Right)—There are two sets of three lights and one audible signal on each bridge

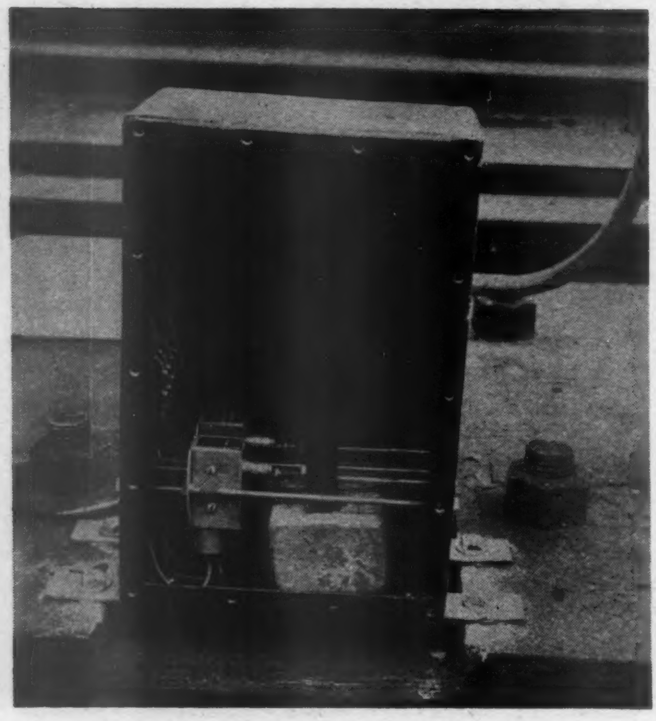


Fig. 4—One of the bridge longitudinal tilt gauges

which terminate at the water's edge in four 2-track loading bridges which are hinged at the shore end.

The loading bridges, generally known as float bridges, consist of wooden trusses on metal pontoons and since they are on pontoons, the outer ends of the bridges rise and fall with the tide. Each bridge is approximately 40 ft. wide and 100 ft. long. For the purpose of loading, one end of a car float is placed against the end of a bridge and secured in place by lines and several toggles which hold the track ends on the float and the bridge in alignment.

When the tide is high, there is an upgrade from the shore to the deck of the car float. This involves no hazard. When the tide is low, the grade to the float is down, and when the tide is very low, there is the possibility of cars uncoupling, due to the angularity at the bridge hinge, and running free down the bridge onto the float.

A second hazard which must be avoided is loading one side of a float too heavily. This could cause cars to tip sidewise off the float into the water. Safe limits of grade due to low tide, and of tilt caused by loading, have been established by measurement and experience, and gauges have been applied which give visible and audible signals to guide the work of the switching crews doing the loading. Green lights show a safe condition for loading cars of all weights, yellow lights indicate that some precautions are required, and red lights indicate a condition which must be corrected. A red indication is accompanied by an audible signal, which continues to sound until the condition is corrected.

A lateral tilt gauge is shown in Fig. 2. There is one of these mounted on each bridge. They consist of four Mercoid switches mounted on two strap hinges in a cast iron gasketed metal box. The small lamp which may be seen at the front keeps the temperature in the box from getting too low.

One of the sets of signals which are on each bridge is shown in Fig. 3. The green light burns continuously, and the yellow and red lights are caused to light by the Mercoid switches. When one side of the bridge is approximately 3 ft. lower than the other, one of the two Mercoids marked "Y" closes the circuit to the yellow light. If the tilt is in the other direction, the other switch marked "Y" closes the yellow light circuit. Similarly, if the tilt in either direction becomes approximately 4 ft., the red signal is lighted and the audible signal caused to sound. The ends of the hinges are supported by nuts on threaded rods to permit positive adjustment of the angle required for recording the tilt of the bridge. The hazardous conditions indicated are corrected by pulling cars off one side of the float or by adding cars to the other.

On each bridge, there is also a longitudinal tilt gauge as shown in Fig. 4. The box contains two heavy pendulums and two micro switches which will operate on a pressure of two ounces. The gauge is shown when the floating end of the bridge is high, and the pendulums

(*Continued on page 429*)

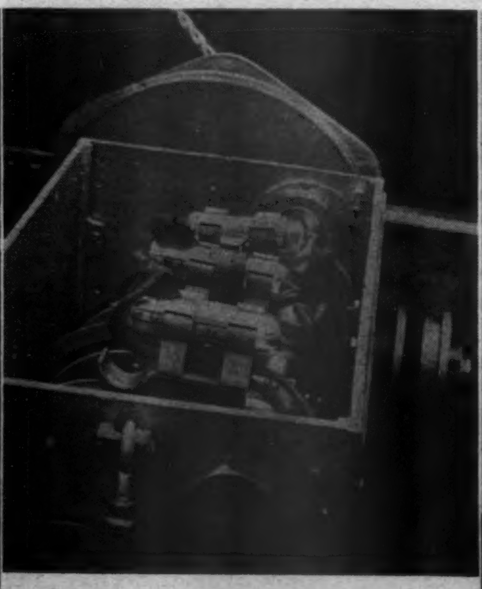


Fig. 6 (Above)—Close-up of the tide gauge controller with cover removed

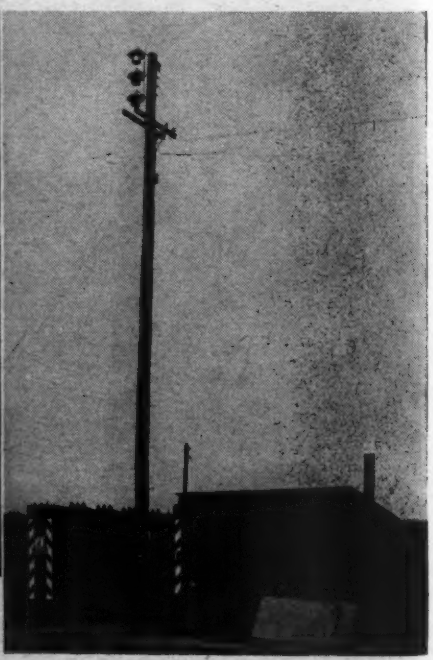


Fig. 5 (Left)—The tide gauge controller—Fig. 7 (Right)—Tide gauge lights for giving indications of tide conditions to yard operators—View taken from the yard looking toward the loading bridges

Lighting of Passenger Cars

Part II

By A. J. Manson*

Optical factors and practical considerations which should govern design of a good passenger car lighting installation

THE previous article has emphasized the suitability of the fluorescent lamp for railroad passenger car use from the standpoint of efficiency; its lower wattage drain on the battery, and the fewer lamp replacements due to its greatly increased average life over that of the incandescent lamp.

In the design and layout of such a fluorescent lighting system there are many things to consider, the most important of which are:

1. Engineered design from the optical standpoint.
2. Illumination from one central source.
3. Design to provide various light distributions to meet any railroad requirements.
4. Complete layout composed of a number of similar units.
5. Selection of units to facilitate ease of lamp replacement and low maintenance.

Engineered Design from the Optical Standpoint

The intelligent application of light sources requires, first of all, a familiarity with the units used in the measurement of light and illumination. The four fundamental factors associated with the measurement of light are luminous intensity or candlepower, luminous flux, illumination and brightness.

Candlepower—Luminous Intensity of Light Sources.—A candle-power measurement specifies the luminous intensity of any light source in a given direction and represents the light intensity in that direction. However, the candlepower measured in one direction is no indication of the total amount of light produced by the illuminant. It is necessary to know the candlepower in all directions before the illuminant's total light output can be determined.

The Lumen—Quantity of Light.—The unit of light flux or light quantity is the lumen. It may be defined as the amount of light falling on a surface one square foot in area, every point of which is one foot from a uniform source of one candlepower. (Square foot of the inside surface area of a sphere of one-foot radius.) If the area is doubled, it will be two lumens. Since the total surface area of a sphere with one-foot radius is 12.57 sq. ft., a uniform one candlepower source of light emits a total of 12.57 lumens. For general practice it is considered as 10 lumens.

The Footcandle—Unit of Illumination.—Light may be termed the cause, and illumination the effect or result. Candlepower and lumens are both a measure of the cause. For the measurement of illumination, a unit known as the "footcandle" is used. A footcandle represents the illumination at a point on a surface which is one foot distant from and perpendicular to the rays of a one candlepower light source. The illumination of any surface other than the interior of a sphere of one-foot radius with a one candlepower source at its center lessens from the center towards the edges since the distance from the source increases beyond one foot and the light strikes at a slight angle. A footcandle reading applies only to the particular point where the measurement is made. By averaging the footcandles at a number of points, the average illumination of any given surface can be obtained. Some of the footcandle levels experienced in everyday life are:

Moonlight	0.02
Well-lighted street (average)	1.0
Well-lighted interior	50 to 100
Daylight	
In shade (outdoors)	100— 1,000
Direct sunlight	5,000—10,000

There is an important relationship between the lumen and the footcandle. A lumen is the amount of light flux spread over one square foot of area which will illuminate that area to a level of one footcandle,—i.e., one footcandle = one lumen per square foot. When the number of square feet to be lighted is known and the desired level of illumination decided upon, the number of lumens which must be provided on the working plane is easily determined. For example, to illuminate 100 sq. ft. to an average level of 5 footcandles, 500 lumens would have to be distributed uniformly over this area. This may be expressed as follows:

Area (sq. ft.) × footcandles (average) = total lumens.

Illumination decreases not in proportion to distance, but in proportion to the square of distance. This fact is referred to as the "Inverse Square Law" and is based upon a point source of light. Practically, it applies with close approximation where the diameter of the light source is not greater than about one-tenth the distance to the illuminated surface. To sum up, it is possible to formulate a general rule whereby the illumination from the point source is equal to the candlepower of the source in the direction of the surface divided by the square of distance in feet from the source to the surface.

Brightness.—The illumination of a surface depends solely upon the light it receives, and not on the character

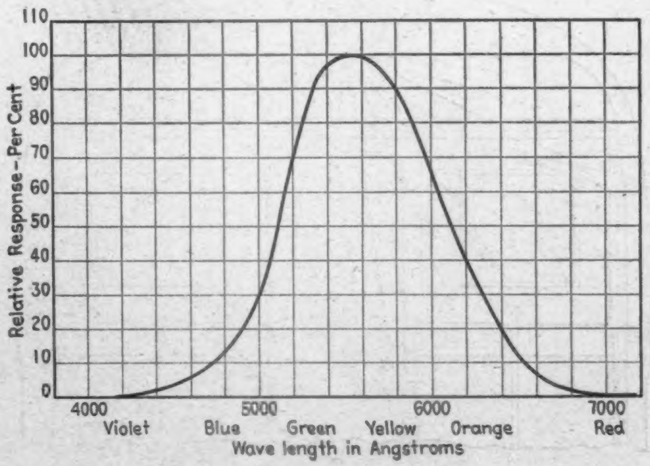


Fig. 7—Eye sensitivity curve showing relative visibility of different wavelengths of light

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of the surface. Brightness, on the other hand, depends upon the nature of the surface as much as upon the light falling on it. Part of the light falling on a surface is reflected and part absorbed and a part may be transmitted. A surface which reflects or transmits light appears to be emitting light. It is by reason of this that a surface of an object appears bright.

A piece of white paper may reflect 80 per cent of the light incident upon it, whereas a gray paper reflects only 40 per cent, both having a uniform ilumination of foot-candles. The white paper will be twice as bright in appearance. Since the purpose of light is to make vision possible, it is recognized that brightness is one of the most important factors with which the illuminating engineer has to deal. Brightness is expressed in terms of "candles per square inch" or in terms of the "Foot-lambert" which is the brightness of a surface which emits one lumen per square foot.

To summarize: The four units which must be considered in illuminating engineering as applied to railroad passenger cars are:

Quantity Measured	*Unit*
Luminous Intensity	Candlepower
Luminous Flux	Lumen
Illumination	Footcandle
Brightness	Candle per sq. in. or Foot-Lambert

The primary purpose of lighting is to make seeing possible. It is, therefore, apparent that the designer of a lighting system should be familiar with the various characteristics of the human eye. The eye sensitivity can be plotted in curve form which indicates the relative visibility at each wave length throughout the visible range from 4,000 to 7,500 angstroms approximately. It is interesting to know that the radiation from the sun has its maximum intensity at a point corresponding closely to the maximum of this human visibility curve. It can be theorized and rightly so, that the visual sensitivity has been developed under the influence of sunlight.

The curve of eye sensitivity in reference to the visual spectrum is shown in Fig. 7. The problem of efficient light production is largely that of radiating as much as possible of the energy expended in the illuminant at wave lengths to which the eye is most sensitive and within limits of visibility represented by wave lengths of 0.38 angstroms to 0.76 angstroms. As a given energy radiated at 0.55 angstroms will produce say 10 times as great illuminating effect as if radiated at 0.65 or 0.45 angstroms. consideration of the distribution of radiation is essential from the illuminating standpoint.

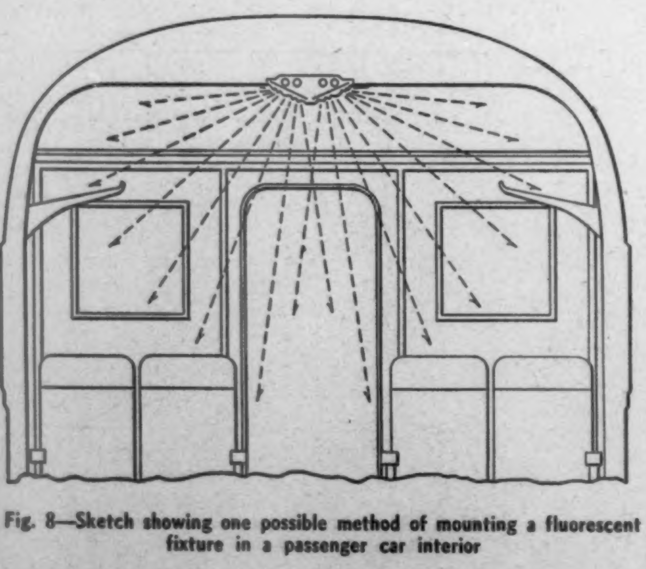


Fig. 8—Sketch showing one possible method of mounting a fluorescent fixture in a passenger car interior

The average human eye has a vision of 30 deg. above and 30 deg. below the horizontal line, i.e., an angularity of 60 deg. in the vertical plane—in the horizontal plane an angularity of approximately 160 deg. One should also appreciate that 87 per cent of all impulses that go to the brain come from the eye.

With his knowledge of the human eye and the process of seeing, the railroad illuminating engineer recognizes the important requirements of a railroad passenger-car lighting system and the substitution, as closely as possible, of artificial illuminants for sunlight. He, therefore, incorporates in his designs the following:

(a) An adequate level of illumination.
(b) Light properly diffused, directed and distributed.
(c) The avoidance of undesirable shadows.
(d) The avoidance of glare.
(e) A steady light free from objectionable variations.
(f) A pleasing decorative effect.

An Adequate Level of Illumination—The human eye has been developed through thousands of years under outdoor illumination. During the major portion of this period, the visual tasks imposed on it were far less than present everyday requirements, which frequently must be performed under a mere fraction of the daylight illumination levels. Therefore, present-day research points definitely towards higher and higher levels.

Proper Diffusion, Direction and Distribution—It need hardly be mentioned that good diffusion is most important to prevent illumination of objects on one side and the casting of harsh shadows.

Knowing the railroad requirements, then the light must be directed to fulfill the visual problem involved.

The distribution of the lighting should be such that the eye is not called upon to make rapid changes from high to low illumination or vice-versa. The problem is to have the illumination fairly uniform throughout.

Avoidance of Glare—The presence of glare is one of the most common and serious faults of lighting. Glare can be defined as any brightness within the field of vision of such a character as to cause discomfort, annoyance, and interference with vision, resulting in eye fatigue. Seeing is handicapped when glare exists. The pupil of the eye being exposed to glare will contract and less light will reach the retina. Thus, its sensitivity is reduced. A poorer result is the effect as compared to the same illumination without excessive brightness in the field.

We may get this glare either directly or reflected. Direct glare is caused by light reaching the eye directly from the source of light. Reflected glare occurs when bright artificial light sources are reflected into the eye from shiny surfaces. Reflected glare is at its worst with artificial lighting equipment of relatively small size and high brightness.

Illumination from One Central Source with Light Distribution

Simplicity, combined with appearance, and low installation costs, as well as conforming to visual requirements, is obtained in railroad passenger cars by fluorescent lighting with continuous fixtures mounted longitudinally in the car and at the center of the ceiling. There is more involved than simplicity in mounting and wiring, ease of maintenance, and a minimum time required for lamp replacements. Scientifically, such an arrangement is ideal. The car ceiling in general is somewhat parabolic and to a certain extent acts as a reflector. The longitudinal layout of the illuminant approaches the correct optical location. Manifestly, the lamps should not be placed crosswise.

Surrounding the lamps with an optically designed enclosure, the light flux can be distributed to meet any railroad requirements without glare. For instance, one railroad may desire more light to be directed on the baggage racks

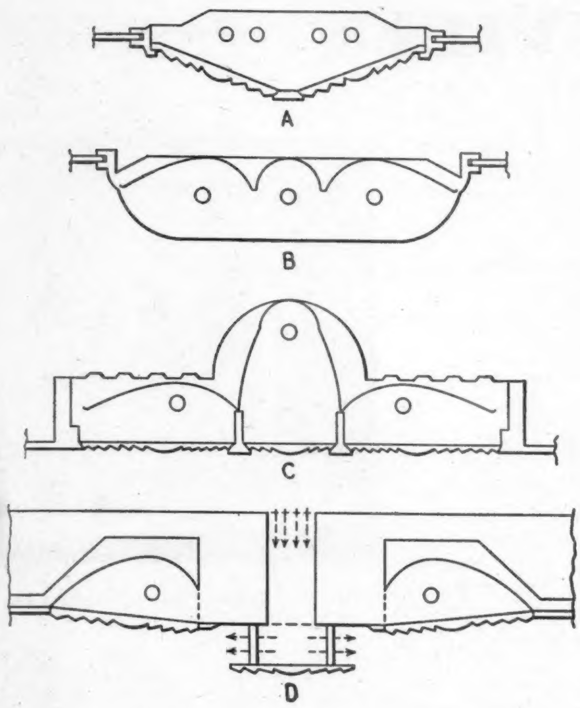


Fig. 9—Sketches showing alternative types of fluorescent fixtures for passenger cars

than another and, at the same time, maintain the same footcandles at the reading level.

A certain amount of light must be directed to the ceiling to illuminate it, otherwise the apparent height of the car is reduced, and a glaring condition created by accentuating apparent brightness of the luminaires by brightness contrast.

In overnight coaches the late night lighting is easily provided by a night circuit of lamps with decreased illumination confined to the aisle only—leaving the seat area in relative darkness.

This design, illumination from one central source, lends itself to any specifications calling for light distribution throughout the passenger compartment. The lenses are scientifically designed. Certain parts can be polished or roughened depending on the desired effect. A pleasing color effect can be obtained by coloring the lens risers without in any way affecting the illumination and the obtaining of the desired footcandles at various levels. The optical system can be laid out accurately.

Such fixtures, adequate for mounting fluorescent lamps can be of unit construction making for low production and installation costs. The types of individual fixtures are kept to a minimum—the wiring and switching are simple and relatively inexpensive. Provision for easy and quick lamp renewals, which means low maintenance, can be incorporated without interference with the distribution efficiency.

Many arrangements and designs are possible with the longitudinal mounting. A simple, attractive, and efficient fixture design with its location is shown in Fig. 8. An enlarged view which does not attempt to include details of design for mounting, facilities for lamp replacements, and scaled dimensions is shown by Sketch A, Fig. 9. This sketch as laid out includes four lamps so that various degrees of illumination can be obtained. Certain requirements may be better fulfilled by the use of only two lamps.

Another arrangement is shown in Sketch B. A translucent panel engineered for illumination to the various parts of the car is used in place of the lenses. Obviously, this is not as efficient from the illuminating standpoint. The translucent panel is a transmitting media, but does not have directional characteristics as do the lenses, to meet specifications requiring varied light intensities at different cross-section locations of the car. The design includes three lamps in the horizontal plane. Combinations can be set up to give different light intensities with the center lamp used only for dimmed lighting.

Another design which retains all the advantages of directional as well as aisle illumination with seat space in relative darkness, is shown in sketch C. Utilizing a bluish lamp for the dim circuit gives an adequate and pleasing effect.

The longitudinal lighting arrangement need not interfere with air-conditioning utilizing a central duct for distribution. Sketch D shows such a combined fixture.

The use of the fluorescent lamp for railroad passenger-car lighting should be given the greatest consideration. It has so many advantages—enumerated and discussed in this and the previous article. The railroads in the very near future will experience keen competition from other means of transportation. Therefore, railroad transportation must appeal to the traveling public as it never has before. Remembering that 87 per cent of all impressions to the human brain pass through the eye, it is obvious that adequate, attractive, and pleasing illumination will play a most important role in maintaining patrons who will be satisfied, and who will endorse and boost the service and the efforts that the railroad management is rendering.

Safe Loading of Car Floats

(*Continued from page 426*)

swing a little to the right away from the switches. As the tide falls, or a load depresses the end of the bridge, the pendulums swing to the left, and press against the operating plungers of the switches. As the limit of safe angularity is approached, one of the switches is closed, lighting the yellow light in the set of three shown in Fig. 3. Greater and unsafe depression of the bridge causes the second switch to close. This lights the red light, and starts the horn.

A tide gauge for indicating loading conditions to the yard operators is shown in Figs. 5 and 6. This gauge operates lights on the pole shown in Fig. 7, which can be seen from any point in the yard. The gauge is mounted on a rigid structure not influenced by the tide and is operated by a ceramic float which rises and falls with the tide. The float is in a vertical pipe, open to the water at the bottom, and containing a quantity of kerosene to prevent freezing in cold weather. The kerosene floats on the water and the float on the kerosene. A flexible tape from the float is run over the operating sheave of the gauge to a weight suspended on the other end of a flexible cable.

The float follows the rise and fall of the tide, and through a gear reduction causes a tilting of the three Mercoid switches shown inside the gauge in Fig. 6. These switches progressively light the three signals shown in Fig. 7. A green light indicates safe loading conditions for cars of all weights, a yellow means that only cars under a certain weight can be loaded, and a red means that all loading must be suspended, pending a rise in the tide.

The tide gauge controller was supplied by the Automatic Control Company, St. Paul, Minn., and the longitudinal and lateral tilt gauges for the bridges are the product of the railroad's electrical department.

NEW DEVICES

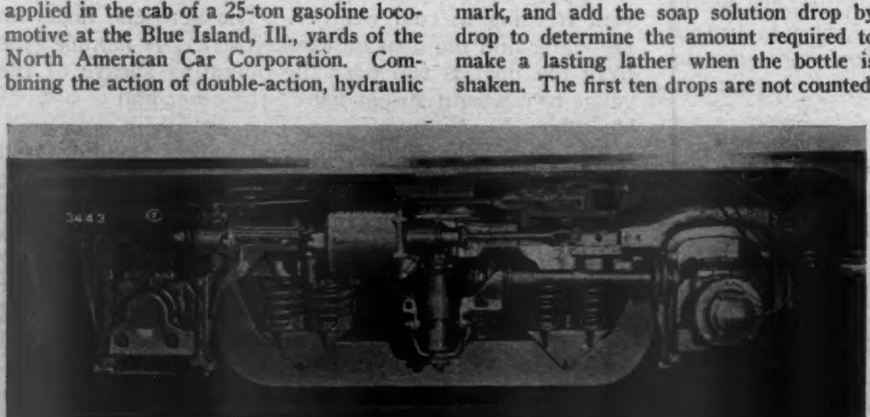
Monroe Shock-Absorber Applications

Two new applications of hydraulic shock absorbers, made by the Monroe Auto Equipment Company, Monroe, Mich., are shown in the illustrations.

The first of these indicates the type of spring suspension and post-war Monroe direct-action shock absorbers used on trucks of the new C. & N. W. "400" streamliner cars, recently built for this railroad by the Pullman-Standard Car Manufacturing Company. The illustration shows a new stem-end mounting of the shock absorbers. Improvements in the shock absorbers themselves include a heat-resisting synthetic seal in addition to the standard leather seal to give a leak-proof bushing; plated piston rods to give micro-dimension bearing surfaces; honed pressure tubes; stronger welds; and extension of the shock-absorber shield to give additional protection against flying cinders and dust.

Monroe easy-ride seat installed in a North American Corporation gasoline switcher

Another new application of Monroe equipment is the hydraulically controlled easy-ride seat for locomotive switchers which is shown in the second illustration applied in the cab of a 25-ton gasoline locomotive at the Blue Island, Ill., yards of the North American Car Corporation. Combining the action of double-action, hydraulic shock absorber, variable-rate spring and sway bar, this seat tends to smooth out the jolts and jars of switching locomotive operation for the engineman. The action is similar to that in Monroe seats for tractors, trucks, speed boats and other vehicles. The shock absorber controls the spring action and cushions the ride up and down, while the sway bar reduces side sway.



Stem-end mounting of Monroe hydraulic shock absorber on new C. & N. W. "400" car truck

Cleaning Fluid

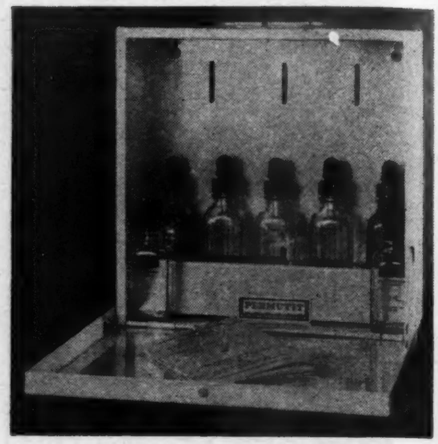
To attain greater speeds and lower costs in industrial steam-cleaning operations, a heavy-duty alkaline-type detergent for use in modern steam guns and coil-type steam-generating mechanisms has been announced by Oakite Products, Inc., 46 Thames street, New York 6. This detergent, called Oakite Composition No. 92, is said to affect reductions in time and cost for such jobs as cleaning equipment and parts for subsequent repair and overhaul, removing oil, grease, road grime from running gear, and stripping paint.

This cleaner is described as giving highly thorough and fast steam-cleaning action at very low concentrations. Specialized advantages include prevention of scale clogs in steam coils, ready dissolution in hot water, free-rinsing action on all surfaces, and safe handling without offensive fumes or toxic vapors.

Portable Boiler Water Testing Kit

The testing of boiler feed water for hardness, alkalinity, and chloride content may be readily accomplished with a kit made by the Permutit Company, 330 West Forty-second street, New York 18. The kit comes in a portable white enamel cabinet 10 in. by 10 in. by 4¾ in., and contains chemical solutions and precision-made pippette droppers for accurate measurements.

To make the test, blow down the sample line and draw the desired amount of water at once. Fill a test bottle to the 20 ml. mark, and add the soap solution drop by drop to determine the amount required to make a lasting lather when the bottle is shaken. The first ten drops are not counted.



The Permutit portable testing kit

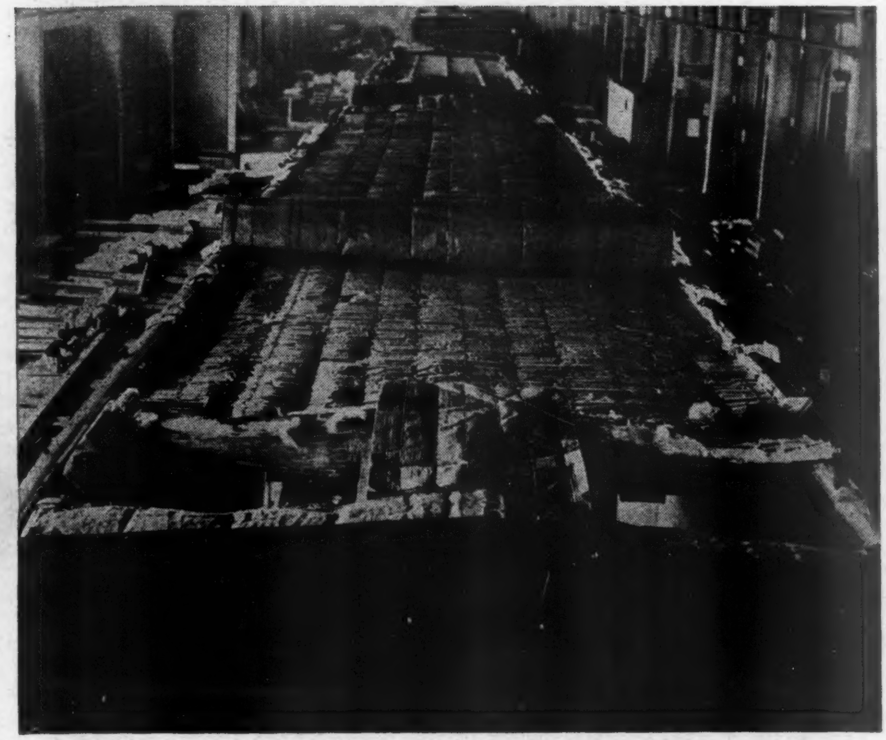
Beginning with the 11th drop, each drop indicates 1 p.p.m. (parts per million) hardness. For the alkalinity test a second bottle is filled to the 20 ml. mark, and five drops of phenolphthalein are added to turn the water pink. Count the number of drops of the sulphuric acid solution needed barely to destroy the pink color. Each drop equals approximately 12 p.p.m. alkalinity. The chloride test is performed by adding five drops of potassium chromate to the sample used for the alkalinity test. The number of drops of silver nitrate solution needed to cause a faint brick-red color to develop are counted and multiplied by twelve to determine the p.p.m. chloride.

The value of 12 p.p.m. per drop given for the alkalinity and the chloride tests is an approximate figure. If greater accuracy is desired, the droppers may be calibrated according to instructions supplied with the kit. In addition to testing feed water, this kit may be used to check the condition of water in the boiler between boiler washes if it is desired to check the adequacy of treatment or of the blowdown frequency.

Ultralite Fiberglas Insulation

Estimated weight savings at more than 800 lb. per car are being secured in the all-welded refrigerator cars which the General American Transportation Corporation is now building for the Pacific Fruit Express and the Atchison, Topeka & Santa Fe, by the use of extremely lightweight Ultralite Fiberglas insulation.

The illustrations show the application of Ultralite, made by the Gustin-Bacon Manufacturing Company, of Kansas City, Mo., to car sides, ends and roofs. This lightweight insulation was developed as aircraft insulation during the war and is now available to railroads and car builders. It is said to be particularly adaptable to both freight- and passenger-car use because of its lightness of weight combined with high thermal and acoustical efficiency. Being made of glass, it is incombustible and non-corrodible and does not absorb



Application of Ultralite insulation in car roof, second layer being placed in position

moisture or odors, nor does it provide sustenance for vermin and rot-inducing agents. Constructed as a resilient blanket, Ultralite tends to stay in place and not settle or shake down under vibration.

Mobile-Type Self-Propelled Arc Welder

A mobile-type self-propelled arc welder to simplify welding operations in the various yards of large railroads has been designed by the Hobart Brothers Company, Troy,

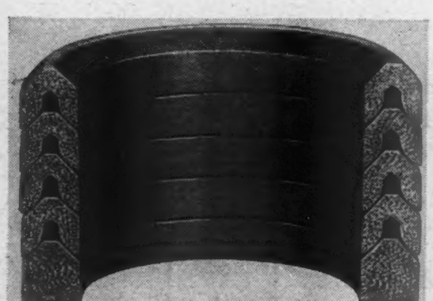
The Hobart self-propelled arc welder

Ohio. The welding equipment consists of a 300-amp. welding generator and tank carriers for acetylene welding. The door to the tool chest in the rear becomes a convenient welding and work bench when opened. A Chrysler industrial six-cylinder engine furnishes power for both welding and transportation. A special cable reel has a capacity for 75 ft. of both electrode and ground cable. The current supplied to the reel permits immediate welding at any desired cable length.

The unit has an automotive-type transmission with three speeds forward and one reverse. It is connected directly to the welding generator. Fluid drive with rear-mounted clutch is used to transmit power to a transfer case, which may be equipped with a one-to-one or a two-to-one gear ratio, depending upon the requirements of the unit. The clutch is the dry-disc type, 10 in. in diameter. The brakes are four-wheel hydraulic, and there is a mehcanical hand brake on the drive shaft. All controls are automotive type, and the unit is mounted on springs and shock absorbers at the front and rear.

Palmetto Pyramid Packing

To lessen the possibility of V-shaped packing weakening and splitting at the hinge, and to improve sealing action, a design known as Palmetto Pyramid Packing has



Pressure-compensating packing rings

been developed by Greene, Tweed & Co., Bronx Boulevard at Two Hundred Thirty-Eighth street, New York 66.

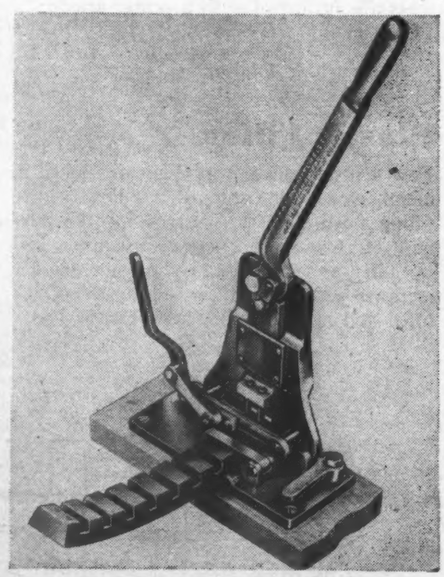
The bottom ring of this packing receives the full impact of the pressure on the power stroke and expands the wedge-shaped lips of each ring above it so that the packing is pressed against both the rod and side walls. Leakage and binding are said to be prevented by the infiltration of the fluid between the rings and the storage of fluid in the arrowhead reservoirs. The curved design of the interior lip surface reduces friction within the packing. On the return stroke the lowering of the pressure permits the built-in restitutional property of each ring to exert itself. This enables the rings to spring or contract to normal, and thereby reduces binding by the packing.

No special adapter ring is required since the top ring has a flat top surface and 45 deg. angle surfaces that accommodate standard shape gland-followers. These packings may be used for rotary as well as reciprocating action. Sets of the rings can be supplied in styles and grades to withstand oil, water, and steam at any pressure, and temperatures to 600 deg. F.

Belt Splicer

A belt splicer has been developed by the Paxton-Mitchell Company, Omaha, Nebr., for the fast and accurate cutting and punching of belts for railway car air-conditioning and generating equipment. With this device it is said that the splicing operation can be completed in one or two minutes. Work can be done at the car, eliminating trips to the service shop.

These splicers are made for use on 2-in. cog V-belts, 1-in. and 2-in. solid V-belts, and 4-in. and 5-in. flat belts. The operating principle is identical for each type of



Belt splicer for railway equipment

belt; when properly inserted in the tool, belts are cut and punched in the same operation to match standard splice fittings. Provision is made for handling various types of splice fittings by the use of different types of punches. The 2-in. V-belt splicer types are equipped with an auxiliary knife which grooves solid belts to permit the entrance of a splice-fitting lip. The splicer for flat belts is equipped for handling various bolt arrangements. A simple change in the tool permits the splicing of two-, three- or four-bolt coupling assemblies.

Glass Fiber Retainer Mats for Battery Use

Glass fiber retainer mats consisting of thin diaphragms or filter screens for enclosing the positive plates of acid-type storage batteries are produced by Johns-Manville, 22 East Fortieth street, New York 16, for use in addition to the wooden or composition separators between positive and negative plates. These retainers hold any migrant granular particles of lead in the facial interstices of the glass fibers, from which they may be restored safely onto the positive plate surface when the battery is charged. Such minute lead oxide particles freed from the positive plate would otherwise drop into the sediment chambers, or might possibly contribute to the formation of a metallic short between plates and shorten the life of the battery. These retainers, nevertheless, permit practically unobstructed passage of electrolyte.

There are thousands of long continuous fiber filaments in every one of the many layers which combine to make up each mat. This built-up section is lightly impregnated with an acid-resistant phenolic type resin and carefully and completely oven-cured. Tests are said to indicate that glass fiber mats lengthen the life of a battery by as much as 50 per cent.

Thicknesses of 10, 20, 30, and 40 mils are standard for storage battery use, but special thicknesses are available from 5 mils to 100 mils for special industrial purposes. For this use mats are available in rolls 50 in. wide by 100 to 150 ft. long, or intermediate sizes as may be required. Double mats are furnished with a center crease.

Plastic Filler

For dents, cracks, scratches or holes in metal, wood, tile, or plastic which require filling flush with the surface for the purpose of refinishing like new, Econite plastic filler is designed to short-cut former methods of maintenance and repair. Once filled and hardened, the filler can be body-filed or sanded to a smooth finish, ready for painting. It withstands alkali or acid solutions and substantially resists heat and water pressure.

This product incorporates in its formula a working base of tough, jar-resistant resinous plastic. Once applied and dry, it has tenacity and wear life equalling that of the material to which it is bonded. Its air-drying properties eliminate the need for torches or applied heat. It is easily applied with a glazing or putty knife. Econite plastic filler is a product of Econite, Inc., 1627 West Fort street, Detroit 16, Mich.

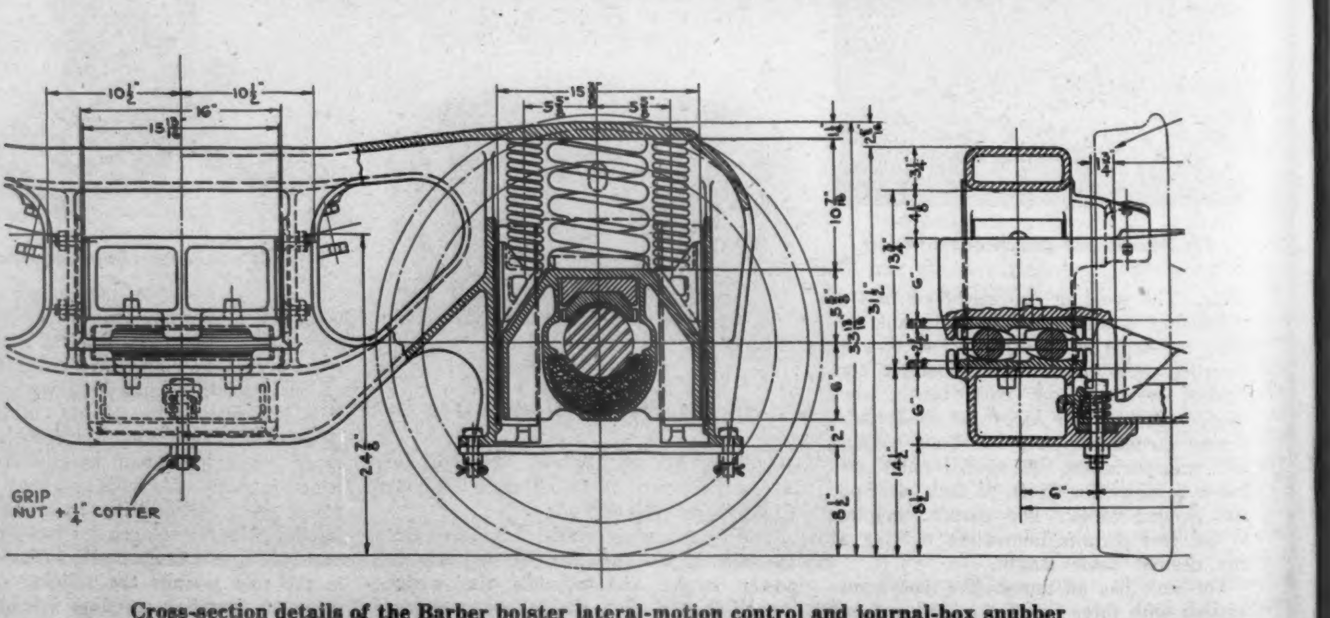
Barber Stabilized Truck

The Barber Stabilized truck for high-speed freight service, type S-5-L, manufactured by the Standard Car Truck Company, Chicago, embodies the use of a special Barber lateral-motion device for lateral control approaching that of swing hangers. This effect is secured by proper design of the curved-bearing surfaces of the drop-forged roller seats and caps, which contact double rollers at either end of the bolster as shown in the sectional drawing. The contour of these curved surfaces is such that one end of the bolster rises slightly as it moves out under lateral impulse from the car body, as would be the case with a bolster supported by swing hangers.

Separate journal boxes of special design incorporate a built-in friction snubbing device at each pedestal opening as illustrated. Referring to the drawing it will be seen that all load-carrying springs are placed over the journal boxes which move in pedestal ways, these being equipped with hardened-steel wear plates. The spring-actuated taper wedge blocks shown are forced outward against the pedestal wear plates as the journal springs oscillate and the side frames move up and down under road shocks. The vertical shocks are thus snubbed out at the journal boxes and not transmitted to the truck side frames. This snubbing action on each journal box tends to eliminate galloping of the side frame and make the truck particularly easy riding and suitable for use either in high-speed freight service or under baggage-express and head-end box equipment in passenger train interchange service.

The new Barber truck is considerably lighter than the conventional four-wheel cast steel freight-car truck. Wheel changing is exceptionally easy as the stabilizer parts, springs or journal boxes need not be removed when a wheel change is made. The new truck design has been approved by the A.A.R. for interchange service.

The Barber S-5-L stabilized freight-car truck



Cross-section details of the Barber bolster lateral-motion control and journal-box snubber

NEWS

Business Papers to Change Trim Size

As a result of recommendations adopted at the May meeting in Hot Springs, Va., of the Associated Business Papers, and accepted at the June meeting in Atlantic City, N. J., of the National Industrial Advertisers Association, the standard trim size of business magazines has been fixed at 8¼ in. by 11¼ in. This change will become effective for the *Railway Mechanical Engineer* and other periodicals published by the Simmons-Boardman Publishing Corporation with the September numbers. There will be no change in the dimensions of the type page.

Charles B. Bryant Heads Technical Board

Charles B. Bryant has been appointed chief engineer of the Technical Board of the Wrought Steel Wheel Industry, with headquarters at Chicago, succeeding C. T. Ripley, whose resignation was announced in the July issue. Mr. Bryant, who was born at Washington, D. C., on November 1, 1900, is a graduate of Johns Hopkins University. In 1922 he was appointed a field engineer of the Portland Cement Association, and in 1930 became materials engineer of the Maryland State Roads Commission. Mr. Bryant entered railway service in 1936 as engineer of tests of the Southern and seven years later became assistant to the vice-president in charge of research and tests. In 1944 he was appointed a director of the Transportation Equipment Division of the War Production Board.

McKee Honored at University of Kentucky

Neal Trimble McKee, vice-president of the Superheater Company, New York, received the honorary degree of Doctor of Science in Engineering at the commencement exercises of the University of Kentucky on June 7. Mr. McKee graduated from the University of Kentucky in 1903 and received the M. E. degree from that institution in 1906.

Award to Dr. L. K. Sillcox

Dr. Lewis K. Sillcox, first vice-president, New York Air Brake Company, was presented with the gold medal of the Institute of Locomotive Engineers of Great Britain at a testimonial dinner to him and W. S. Graff-Baker, chief mechanical engineer of the London Passenger Transport Board and the retiring president of the Institute, held at the Union League Club, New York, June 5, 1946. The dinner, at which W. M. Sheehan, vice-president, General Steel Castings Corporation, presided, was attended by 50 officers and engineers of railways and railway equipment and supply companies, former officers of the American Society of Mechanical Engineers and members of its Railroad Division.

Mr. Graff-Baker was introduced by D. Robert Yarnall, president of the Society. The medal was awarded to Dr. Sillcox for his paper entitled, "Power To Pull," which was presented before the 1942-43 session of the Institute. Mr. Graff-Baker described this paper as a model in its approach to the problem of appraising the relative value of steam and Diesel-electric motive power.

Kiefer Receives Honorary Degree at Stevens

Paul W. Kiefer, chief engineer of motive power and rolling stock of the New York Central System since 1926, received the honorary degree of mechanical engineer from the Stevens Institute of Technology at commencement exercises held on Saturday, June 22, at the College at Hoboken, N. J.

Among his activities in the field of motive-power and rolling-stock design and construction, Mr. Kiefer served as chairman of the Committee on Car Construction of the Mechanical Division, Association of American Railroads, from 1930 to 1941. It was during the period 1931-1932 that the design of the A. A. R. standard steel-sheathed wood-lined box car for unrestricted service was brought to completion and adopted by the Association. This was followed by a number of other standard designs produced during his chairmanship, which have since been built in quantities and widely used. He later was the author of stress analysis reports based on the results of extensometer, deflectometer and impact tests (conducted under the direction of the committee) of the standard box car compared with other well known earlier designs.

He is a fellow of the American Society of Mechanical Engineers, a member of the Committee on Science and the Arts and of the standing subcommittee of the George R. Henderson Medal Committee of the Franklin Institute of Philadelphia.

Among other presentations on equipment design, Mr. Kiefer was the author of an

Orders and Inquiries for New Equipment Placed Since the Closing of the July Issue

Locomotive Orders

Road	No. of locos.	Type of loco.	Builder
American Rolling Mill Co.	1	660 hp. Diesel-elec.	Baldwin Loco. Wks.
Crows Nest Pass Coal Co., Ltd. (Canada)	1	660 hp. Diesel-elec.	Baldwin Loco. Wks.
Erie	3[1]	6,000-hp. four-unit Diesel-elec. frt.	Electro-Motive
Missouri-Kansas-Texas	6	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
Pere Marquette	2[2]	2,000-hp. Diesel-elec. pass.	Electro-Motive

Freight-Car Orders

Road	No. of cars	Type of car	Builder
Delaware, Lackawanna & Western	500	50-ton hopper	American Car & Fdy.
	500	50-ton hopper	Bethlehem Steel
	500	50-ton box	Magor Car
Missouri-Kansas-Texas	100	70-ton covered hopper	American Car & Fdry.
Pere Marquette	25	Caboose	Harlan & Hollingsworth
Union Tank Lines	500	50-ton tank	American Car & Fdry.
	100	50-ton tank	General American

Freight-Car Inquiries

Road	No. of cars	Type of car	Builder
Central of Georgia	200-400	50-ton pulp-wood	
Chicago & Northwestern	140	70-ton covered hopper	
Erie	500	50-ton box	
	200	70-ton gondolas	
	300	50-ton hopper	
Western Pacific	250	40-ton box	

Passenger-Car Orders

Road	No. of cars	Type of car	Builder
Delaware, Lackawanna & Western	6	Sleeping	American Car & Fdry.
Atlantic Coast Line (in conjunction with the Pennsylvania, the Richmond, Fredericksburg & Potomac and the Florida East Coast)	3[3]	Baggage	American Car & Fdry.
	19[3]	Sleeping	American Car & Fdry.
	52[3]	Sleeping	Pullman-Standard
	30[3]	Coaches	Pullman-Standard
	13[3]	Dining	Pullman-Standard

[1] For use between Marion, Ohio, and Salamanca, N. Y., as an addition to the fleet of six 5,400-hp. Diesel-electrics already operating in that territory. An additional 20 Diesel-electric switching locomotives, of which 11 will have 1,000 hp., eight will have 600 hp. and one will have 380 hp., are being ordered. Delivery of these is expected during the last quarter and they will be assigned to freight switching terminals at various points along the line.

[2] Delivery has been taken of these two locomotives which will haul the "Pere Marquette" streamliners.

[3] Deliveries expected to begin around mid-1947.

extensive paper on "Modern Steam Passenger Locomotives, Research and Design", presented before the American Society of Mechanical Engineers at Kansas City, Mo., on June 17, 1941.

Physical and Chemical Analyses of Nickel-Steel Driving Rods

ONLY the typical chemical analysis of the nickel steel used in the making of locomotive driving rods at the Marshall, Tex., shops of the Texas & Pacific is given in the description of this process beginning on page 358 of the July *Railway Mechanical Engineer*. The limits of the specifications and the physical properties of the material are as shown below.

CHEMICAL ANALYSIS

	Per cent
Carbon	0.25—0.35
Nickel	2.50—3.00
Manganese	0.60—1.00
Silicon	0.20—0.30
Phosphorous, max.	0.45
Sulphur, max.	0.45

PHYSICAL PROPERTIES

Minimum yield per sq. in., lb.	70,000
Minimum tensile strength per sq. in., lb.	100,000
Elongation in 2 in., min., per cent	25
Reduction in area, per cent:	
Minimum	50
Desired	60

King Calls for Drive on Car Repairs

DEPUTY Director Homer C. King of the Office of Defense Transportation has called upon the railroads to turn every effort toward reducing bad-order cars to a minimum. The call went out on June 27 in letters to J. J. Pelley, president of the Association of American Railroads, and J. M. Hood, president of the American Short Line Railroad Association, who were assured that the railroads would receive O.D.T. backing in their efforts to obtain any repair materials in short supply.

"New cars," Mr. King said, "must be obtained as quickly as possible, both to increase ownership and to replace equipment which must be retired but new car production cannot solve the present car supply dilemma. It is obvious that the major relief must come once again through more prompt repair of existing equipment. The railroads should strive to reduce the percentage of cars awaiting repair from the present figure of 4.9 per cent to the war time record when for many months it was below 3 per cent."

Road Tests of A. A. R. "All-Purpose" Reefer

A SERIES of road tests of railroad refrigerator cars is being conducted as part of an "extensive two-year research program to develop a standard all-purpose car for the more efficient and dependable transportation of perishables," the Association of American Railroads announced on July 8. The tests are being carried on by the association with the cooperation and assistance of shippers, refrigerator car lines, the United Fresh Fruit & Vegetable Association and such agencies as the United States Department of Agriculture and the Interstate Commerce Commission.

Nine experimental runs confined primarily to matters of car design are scheduled for the summer months, the last of the series to take place in September. Later tests will deal with the service or perishable protective features of refrigerator cars. The runs scheduled for this summer include hauls of citrus from Florida to New York, citrus or tomatoes from Texas to Chicago, cantaloupes and citrus from California to New York, and frozen foods from the Northwest to New York.

A. S. M. E. Technical Meeting at Chicago Cancelled

THE A. S. M. E. Railroad Division technical meeting on further possible weight savings in passenger-car specialties and materials, originally scheduled to be held at Chicago on June 19, has been cancelled for the summer. It will be presented at the annual meeting of the Society at New York on December 4 and 5.

While the technical session of the Railroad Division at Chicago has been cancelled, the dinner and evening meeting in conjunction with and preceding the A. A. R. Mechanical and Purchases & Stores Division meetings will be held as planned at the Congress Hotel on August 7. Features of the dinner meeting will be an address on "The Challenge of the Future", by Samuel O. Dunn, editor-in-chief *Railway Mechanical Engineer*, and chairman, Simmons-Boardman Publishing Corporation, and the presentation of honorary membership in the A. S. M. E. to Ralph Budd, president of the Chicago, Burlington & Quincy.

Lincoln Foundation Announces $200,000 Award Program

AN opportunity for those engaged in the design, manufacture or construction of any type of railroad equipment and the mechanical and structural parts of such equipment, is offered by the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, in the announcement for their new $200,000 "Design-for-Progress" Award Program.

The "Railroad" classification, one of 15, is divided into two divisions: (1) Locomotives or parts, and (2) Cars or parts. Railroad maintenance workers may also enter the competition under the Program's "Maintenance" classification.

Twelve awards, totalling $9,000, established for the "Railroad" classification are:

	Div. 1	Div. 2	Class.
First	$700	$700	$2,500
Second	500	500	1,500
Third	250	250	1,000
Fourth	150	150	800

Three winners of divisional and classificational awards will also be possible recipients of the main program awards of $10,000, $7,500 and $5,000, respectively. The principal program award, which may be won by a paper in the "Railroad" classification, is $13,200. An author entering his paper in either division of the "Railroad" classification, not winning any other award, may still win one of the 217 honorable mention awards of $100 each.

The 452 awards for the entire program are grouped as follows: A total of 172 divisional awards—first, second, third and fourth awards of $700, $500, $250 and $150, respectively, in each of the 43 divisions. A total of 60 classification awards—first, second, third and fourth awards of $2,500, $1,500, $1,000 and $800, respectively, in each of the 15 classifications. A total of three main awards—first, second, third awards of $10,000, $7,500 and $5,000, respectively. A total of 217 honorable mention awards of $100 each for 217 papers which do not share in any other award but deserve honorable mention in any of the divisions.

The 172 divisional awards will be determined first and from them will be selected the 60 papers to receive the classification awards. These, in turn, will be judged to determine the three main awards of the program. After all divisional, classificational and main awards have been determined, papers will be selected to receive the honorable mention awards.

Complete details of The $200,000 "Design-for-Progress" Award Program, which closes June 1, 1947, may be obtained by writing to the secretary, The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

Anniversary of First Locomotive Patent

ON July 13, 110 years ago, the Association of American Railroads has pointed out, the United States issued its first numbered patent, which was for a locomotive "designed to give a multiplied tractive power to the locomotive and to prevent the evil of the sliding of the wheels."

The patent was issued to John Ruggles, United States senator from Maine, who was largely responsible for the passage of the act of July 4, 1836, which set up the present-day method of issuing and numbering patents. Senator Ruggles' invention was a gear-like arrangement for locomotive wheel and railroad rail which would mesh for grades. It was outmoded almost as soon as it was patented. Steam locomotives of today contain around 1,000 patented features.

Smoke Prevention Meeting

THE 39th Annual Meeting of the Smoke Prevention Association of America was held at the Hotel Nicollet, Minneapolis, Minn., June 23-26, and was characterized by the relatively large number of railroad representatives in attendance; the Railroad Smoke Association of Hudson county, N. J., was particularly well represented. The Tuesday afternoon and Wednesday morning sessions were in charge of the Railroad Committee, Eugene D. Benton, until recently with the Louisville & Nashville, but now research engineer of the Fuels Division of the Battelle Memorial Institute, presiding.

The program for these two sessions included addresses on Railroad Smoke Abatement by Roy V. Wright, editor of the *Railway Mechanical Engineer;* Automatic Controls for Locomotive Overfire Air Jets, by John Canetta, Westinghouse Air Brake Company; Railroad Motive Power Trends, by Ralph P. Johnson, chief engineer, Baldwin Locomotive Works, and the Supply of Air to Coal-Fired Steam Locomotives, by Ralph A. Sherman, supervisor, Fuels Division, Battelle Memorial Institute. There was also a demonstration of locomo-

tives equipped with overfire steam air jets at nearby station of the Chicago, Milwaukee, St. Paul & Pacific.

The newly elected officers of the Smoke Prevention Association are: president, Sumner B. Ely, superintendent, Bureau of Smoke Regulation, Pittsburgh; first vice-president, Eugene D. Benton, research engineer, Fuels Division, Battelle Memorial Institute, Columbus, Ohio; second vice-president, C. J. Sokel, chief clerk, mechanical department, Belt Railway Company of Chicago; secretary, Frank A. Chambers, deputy smoke inspector, Chicago; sergeant-at-arms, G. C. Hess, road foreman of engines, Pennsylvania Railroad, Jersey City, N. J. A new office was created and W. E. E. Koepler, secretary, Pocahontas Operators' Association, Bluefield, W. Va., was elected director of public relations. The 1947 convention will be held at Toronto.

New York Central Gets Poppet Valve Locomotive

The New York Central has taken delivery of a Niagara-type locomotive specially equipped with the Franklin system of cylinder steam distribution through the use of poppet valves. The new locomotive will be tested under road conditions in comparison with other locomotives of the Niagara coal-fired, steam-powered type, employing conventional piston-type valve operation, which will be the first time, the announcement said, that such direct comparison has been made between locomotives which are otherwise identical. The new Niagara, class S-2a, is the twenty-seventh locomotive of this type to be delivered to the New York Central by the American Locomotive Company.

N. P. Opens Manufacturing and Repair Shop at Brainerd

The Northern Pacific has completed a car-repair and manufacturing shop at Brainerd, Minn., which was opened formally on June 14, in connection with the celebration of the seventy-fifth anniversary of the founding of that city. Four of the general offices of the railway participated actively in the opening ceremony, namely, Bernard Blum, chief engineer; G. L. Ernstrom, general mechanical superintendent; F. G. Moody, superintendent car department, and F. C. Turner, general storekeeper.

Mr. Blum described the new shop, which consists of a main building more than 800 ft. long, containing a fabrication shop or machine area, 80 ft. by 615 ft., and an erecting shop, 100 ft. by 810 ft. An annex, 34 ft. by 300 ft., contains a locker room, a lunch room, two toilets, a first-aid room and office space. Also, there is a warehouse, 100 ft. by 278 ft., and a covered storage shed 196 ft. long. Adjacent to the warehouse is a concrete platform, 120 by 280 ft.

All buildings are supported on concrete foundations while the framing of the shop building is heavy structural steel, and the walls are brick and glass block. Both the fabrication and the erecting bays are equipped with overhead cranes that span the full widths of the respective bays. The crane runway for the fabrication shop extends 280 ft. outside of the building to serve a covered and paved storage space. In addition to the buildings, 3½ miles of new tracks were constructed to serve the new facilities. The shop was designed to complete 10 modern steel freight cars a day, and, in addition, to handle steel-car repairs for the railroad's Eastern district. The total cost of the construction was $1,799,000.

Mr. Ernstrom described the existing locomotive-repair facilities at Brainerd, and the various functions performed by them, pointing out that about 900 employees are engaged in the locomotive and car shops and that the payroll amounted to $2,396,552 in 1945.

Mr. Moody stated that the present car-department force of 400 men, with a monthly payroll of $96,000, will be increased to 500 men, with a monthly payroll of $125,000, as soon as the shop can be placed in full operation. He also stated that during the remainder of the year it is planned to rebuild 1,500 cars, to make heavy repairs to 700 cars and to make light repairs to 1,800 cars, a total of 4,000 cars, at a total cost of $750,000.

Mr. Turner disclosed that Brainerd is the largest supply point on the system, distributing materials to 25 other stores, amounting to about $9,000,000 annually. It is also the concentration point for scrap of which 34,869 tons was handled in 1945.

Supply Trade Notes

Paxton-Mitchell Company. — *William A. Harris* has been appointed service engineer for the Central Western district of the Paxton-Mitchell Company, Omaha, Neb., with headquarters in Chicago. Mr. Harris was previously in the service of the Alton.

◆

Iron & Steel Products, Inc.—*George L. Bladholm,* recently released from the armed forces, has been appointed special representative of Iron & Steel Products, Inc., with headquarters in the company's general offices, Hegewisch Station, Chicago 33. *Charles A. Marshall* has been appointed general manager.

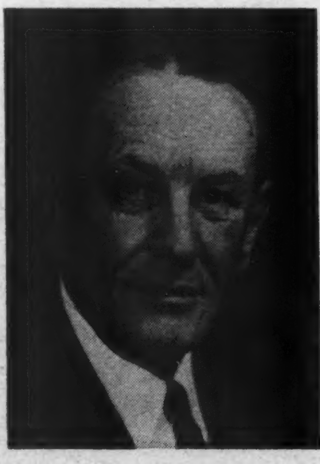
◆

Luminator, Inc.—*Edward C. Zimmerman* and *Robert G. Nordquist* have been promoted to associate design engineers of Luminator, Inc. Mr. Zimmerman has been with the company for 25 years and Mr. Nordquist for nine years.

◆

Rust Oleum Corporation.—*E. W. Kush* has been appointed agent in the railway supply field for Colorado by the Rust Oleum Corporation, and *R. B. Parrish* has been appointed industrial representative in the Michigan territory. *Joseph M. Welles* has been appointed to represent the corporation in southern California, with headquarters at 5421 Santa Fe avenue, Los Angeles, Calif.

Thomas A. Edison, Inc.—*Don C. Wilson* has retired as vice-president, railway sales, Edison Storage Battery division, Thomas A. Edison, Inc. Mr. Wilson was born in Crete, Neb., in 1886. He is a graduate in electrical engineering of the Nebraska State university in 1907. He



Don C. Wilson

began his career in 1908 as a foreman in charge of electrical construction with the Union Pacific and from 1911 to 1916, served as electrical engineer. He worked as electrical engineer in the employ of the Central of Georgia from 1917 to 1918, and joined the Edison Storage Battery Company in 1919 as manager, railway department, which position he held until 1925. Mr. Wilson was general sales manager from 1926 to 1928 and in 1929 was elected president of the D. C. Wilson Company, New York, serving until 1933. He became assistant to the vice-president in charge of railway sales, Edison Storage Battery Division, Thomas A. Edison, Inc., in 1934 and in 1940 was elected vice-president, railway sales.

◆

Weston Electrical Instrument Corporation.—The Weston Electrical Instrument Corporation is constructing a large new engineering and administration building on the plant grounds at Newark, N. J. The three-story structure is to be T-shaped, of brick-faced reinforced concrete and will have 78,620 sq. ft. of floor area.

◆

Kearney & Trecker Corporation.—The Kearney & Trecker Corporation has opened offices at 1426 B. F. Keith building, Cleveland, Ohio; at 925 Frick building, Pittsburgh, Pa., and at 4363 Woodward avenue, Royal Oak, Detroit, Mich. The Cleveland office is under the management of *John E. Brennan,* who will be assisted by *James P. Klinger* and *Lawrence Solin.* Mr. Brennan will also manage the Pittsburgh office where his assistants will be *Eugene C.*

Batcheler, Jr., and *John F. Burg*. At Detroit the office will be directed by *William J. Mirgeler* and *Walter S. Ryan*, assisted by *John C. Berlin, Charles J. Eichman*, and *A. B. Donald*.

◆

AMERICAN BRAKE SHOE COMPANY.—*Roy L. Salter* has been appointed vice-president of the Southern wheel division of the American Brake Shoe Company. Mr. Salter is in charge of operations of the nine Southern wheel plants in the United States and is responsible for the production of chilled-tread car wheels. A graduate of the Alabama Polytechnic Institute, he first joined the Southern wheel division

Roy L. Salter

in 1924 as assistant foreman of the Savannah, Ga., plant and since then has worked in a supervisory capacity at plants in Portsmouth, Va., and Sayre, Pa. He took a leave of absence between 1937 and 1942 to serve with the Association of Manufacturers of Chilled Tread Car Wheels. He returned to Southern wheel as general superintendent and became works manager of the division in 1944.

Plans for a new $2,000,000 non-ferrous foundry at Meadville, Pa., have been announced by *T. W. Pettus*, president of the National bearing division of the *American Brake Shoe Company*. The new plant will replace the old foundry at Meadville and is part of the company's $12,500,000 expansion program. It will produce bronze bearings and castings, and its facilities will provide additional capacity over the old plant. It is expected the concrete and brick buildings will be ready for operation by April 1, 1947.

◆

THE DETREX CORPORATION.—The Detrex Corporation has announced that the new location of its administrative staff and plant headquarters is 14331 Woodrow Wilson avenue, Detroit, Mich. All mail and general operational matters should be referred to Box 501, Roosevelt Park annex, Detroit 32.

◆

ASHTON VALVE COMPANY; CROSBY STEAM GAGE & VALVE CO.—*William P. Husband, Jr.*, president and treasurer of the Ashton Valve Company, Cambridge, Mass., has been elected also president and treasurer of the Crosby Steam Gage & Valve Co., Boston, Mass. Substantial advantages will accrue to the customers of both companies as a result of joint management, it was announced. Improvement in products and the elimination of duplication will reduce operating costs. The railroad department of the Ashton Valve Company, Chicago, has been moved to 140 South Dearborn street, Chicago 3.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*Sidney C. Palmer* has been appointed manager of the marine and transportation divisions, and *Frederick S. Bacon, Jr.*, manager of the central station division, for the New England district of the Westinghouse Electric Corporation. Both will be located in Boston, Mass.

◆

AIREON MANUFACTURING CORPORATION.—*Railway Radiotelephone & Signals, Inc.*, a new corporation, has been formed to serve as the exclusive distributor of Aireon Manufacturing Corporation, of Kansas City, Kan., for its railroad radio and other communications equipment. The president of the new corporation is *William H. Hahn*, of Baltimore, Md., who also heads the Standard Railroad Signals & Fusee Co. *Samuel W. Fordyce, III*, is vice-president and general manager, and *E. W. Purcell*, of Boonton N. J., is also a vice-president. *Dr. C. N. Kimball* is engineering consultant, *J. E. Derham* of Kansas City is assistant general manager, and *W. D. Siedel* is the Chicago division manager.

◆

BURY COMPRESSOR COMPANY. — *B. C. O'Brien* has been elected president and general manager of the Bury Compressor Company, Erie, Ohio. Before joining Bury Compressor, Mr. O'Brien, a graduate in mechanical engineering of the Rose Polytechnic Institute, was associated for a number of years with the Roots-Connersville Blower Corporation, where he was vice-president and general manager.

◆

PITTSBURGH STEEL FOUNDRY CORPORATION.—The Ward Weller Company, Cambridge, Mass., has been appointed New England representative of the Pittsburgh Steel Foundry Corporation. *Ward Weller*, head of the Cambridge firm, will represent both Pittsburgh Steel Foundry and its Fort Pitt castings division in the railroad, marine, heavy automotive and general machinery fields in New England.

◆

NELSON SALES CORPORATION.—*Richard O. Blankmeyer, Kenneth Knotts, Leslie E. Bluhm, Al Wrigley, Jack Godley* and *William G. Tawse*, have been appointed field engineers for the *Nelson Sales Corporation*, Lorain, Ohio. Mr. Blankmeyer will have headquarters in Fayetteville, N. Y., and will cover the upstate New York and northern Pennsylvania area. Mr. Knotts, with headquarters in Pittsburgh, Pa., will cover the western Pennsylvania, southeastern Ohio, western Maryland and West Virginia area. Mr. Bluhm will cover the Delaware, eastern Maryland, Washington, D. C., Virginia, and North Carolina area from headquarters in Hyattsville, Md. Mr. Wrigley and Mr. Godley will handle the Detroit area jointly, with the former also covering northeastern Michigan, and Mr. Godley also covering northwestern Ohio and the Fort Wayne, Ind., territory. Both will have headquarters in Detroit, Mich. Mr. Tawse, with headquarters in Los Angeles, Calif., will cover southern California.

◆

CARBOLOY COMPANY. — The Carboloy Company of Detroit, Mich., has appointed the *Carey-McFall Company*, 2156 E. Dauphin street, Philadelphia 25, Pa., as an authorized distributor to handle hard-metal products in metropolitan Philadelphia and the adjacent territory. Carboloy standard tools, standard blanks, wheel dressers and masonry drills will be carried in stock. In addition, Carey-McFall possesses facilities for fabricating special Carboloy cemented carbide tools and dies and clamped-on Carboloy tools. A regrinding service is also maintained for carbide users. *E. M. Twelves*, sales manager for Carey-McFall, will head the new carbide operation.

◆

BAKER-RAULANG COMPANY. — *Major Carl R. Tufts* has joined the Detroit, Mich., staff of the Baker industrial truck division of the Baker-Raulang Company, Cleveland, Ohio. J. K. Hahaffey & Son have been appointed industrial truck division representatives in the Pittsburgh, Pa., area.

◆

STANDARD RAILWAY EQUIPMENT COMPANY.—*Arthur A. Frank, Jr.*, recently released from the Army with the rank of lieutenant-colonel, has been appointed assistant to the president of the Standard Railway Equipment Company, with headquarters at Chicago. Mr. Frank, upon his graduation from Yale University in 1936,

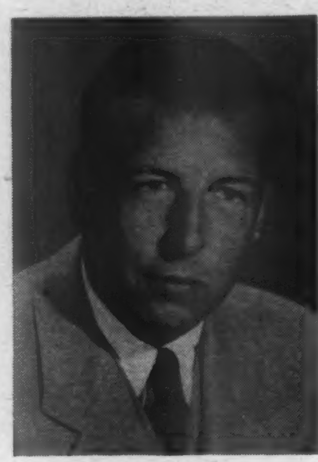
Arthur A. Frank, Jr.

joined the Harnischfeger Corporation, Milwaukee, Wis., as a student engineer. In 1937, he became a sales engineer of the Hollup Corporation, with headquarters at Chicago, and in August, 1941, was called into the armed forces. He served abroad for more than two years as operations officer of a truck group and returned to America in December, 1945. He was released from the service in March.

◆

AERONAUTICAL PRODUCTS, INC. — Aeronautical Products, Inc., has appointed *Champion Transportation Sales, Inc.*, Chicago, national railroad representatives for the sale of its screw machine parts, railroad hardened and ground bushings and pins, rigid live centers, and other products

ALUMINUM COMPANY OF AMERICA.—*Richard A. Sweet* has been appointed district sales manager, Cleveland, Ohio, for the Aluminum Company of America to succeed *Edward L. Cheyney,* who has relinquished his direct responsibilities in that position. Mr. Cheyney will retire from the firm on October 1, after 41 years of service.



Richard A. Sweet

A native of Erie, Pa., Richard A. Sweet began his career with the Aluminum Company at the New Kensington (Pa.) works in 1927. He was transferred to the Cleveland works for a brief period in 1928, and was then assigned to general sales at the New York district office. He was assistant manager of the New York office before being transferred to Cleveland as assistant district manager in January, 1945.

Thomas D. Jolly, vice-president and chief engineer of the Aluminum Company of America, has announced the company's plans for the construction of a large new plant near Davenport, Iowa, for the rolling of aluminum sheet and plate. The plant, which is to cost more than $30,000,000, will have capacity to produce more than ten millions pounds of sheet and plate a month when placed in operation. Construction is scheduled to begin as soon as the project has been approved by the Civilian Production Administration, and completion of the plant will require approximately 18 months. Under present plans, Mr. Jolly said, the new plant will be able to turn out wider aluminum sheet than any other aluminum rolling mill in the world.

◆

STEWART-WARNER CORPORATION.—*Charles I. Kraus* has been appointed sales manager of the Alemite distribution division of the Stewart-Warner Corporation. *Gustave Treffeisen* has been appointed assistant sales manager.

◆

LINK-BELT COMPANY.—*George P. Torrence,* president of the Cleveland Pneumatic Tool Company and vice-president and general manager of the Rayon Machnery Corporation since 1936, has rejoined the *Link-Belt Company* as executive vice-president. Mr. Torrence, scheduled to become president of Link-Belt on November 1, after the retirement of William C. Carter, was with the firm from 1911 to 1936, when he resigned as president.

The Link-Belt Company has opened three new sales offices, at Moline, Ill., Cincinnati, Ohio, and Birmingham, Ala. Those in charge of the branches are respectively, *M. J. Parykaza, L. R. Clark,* and *C. C. Wiley,* district sales engineers.

◆

EATON MANUFACTURING COMPANY.—The Eaton Manufacturing Company has announced the construction of a new office building in Massillon, Ohio. The two-story building, of brick and steel construction, will house personnel employed in the administrative, advertising, employment, cost, engineering, and purchasing departments, and is expected to be ready for occupancy early in the fall.

◆

PRESSED STEEL CAR COMPANY.—*J. F. MacEnulty,* formerly vice-chairman of the board of directors of the Pressed Steel Car Company, has been elected chairman to succeed *Lester N. Selig,* who has resigned as chairman and a director. Mr. MacEnulty's headquarters will remain at the company's New York offices, 230 Park avenue. The company announced that Mr. Selig's resignation, as well as that of *Walter J. Curley,* who also resigned as a director, were made necessary by the acquisition by Pressed Steel Car of the plant of the Mt. Vernon

J. F. MacEnulty

Car Manufacturing Company, at Mt. Vernon, Ill., which brought Pressed Steel Car into competition with the General American Transportation Corporation, of which both Mr. Selig and Mr. Curley were officers.

J. F. MacEnulty was born in Pittsburgh, Pa. He joined Pressed Steel Car as car inspector shortly after its incorporation, and later advanced through various departments of the company, being elected a director in 1922. When the company was reorganized in 1936, Mr. MacEnulty was elected a director and vice-president and in December, 1937, he became president and in April, 1945, vice-chairman. In 1933 he was elected president of the American Railway Car Institute, which office he held consecutively for 10 years when he found it necessary to resign because of business conditions.

◆

MIDVALE COMPANY.—*Frank K. Metzger* has been appointed manager of railroad sales for the *Midvale Company,* with headquarters in Philadelphia, Pa.

CHICAGO PNEUMATIC TOOL COMPANY.—*W. Luther Lewis,* who has been executive vice-president of the Chicago Pneumatic Tool Company since 1931, has been elected president to succeed *H. A. Jackson,* who will continue as chairman of the board of directors. *Robert A. Rankin* has been appointed sales manager of the Diesel-engine division. Mr. Rankin, formerly assistant manager of the engine division, succeeds *H. W. Buker,* head of Diesel-engine sales for the last 20 years, who has retired after 26 years' service with the company.

◆

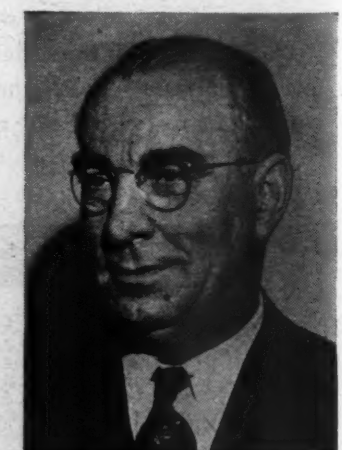
GRAYBAR ELECTRIC COMPANY. — *C. H. McClean* has been appointed northern district manager of the Graybar Electric Company, with headquarters in Minneapolis, Minn. He has been succeeded as midwestern district manager, with headquarters in Kansas City, Mo., by *Walter Frasier.* Mr. McClean succeeds *E. C. Sharpe,* who is retiring after more than 34 years of service with the company.

◆

NATIONAL PNEUMATIC COMPANY.—The National Pneumatic Company has transferred its Eastern sales offices from 420 Lexington avenue, New York, to the plant offices at Rahway, N. J. The executive offices will remain at the New York address. All correspondence concerning sales or services formerly mailed to New York, should be addressed to the company at Rahway.

◆

AMERICAN BRIDGE COMPANY; VIRGINIA BRIDGE COMPANY.—*Frank K. McDanel* has been elected president of the American Bridge Company and the Virginia Bridge Company, subsidiaries of the United States Steel Corporation. Mr. McDanel began work as a youth in the Ambridge, Pa., plant of American Bridge where he learned to lay out shapes for bridges and buildings. Rising through the ranks, Mr. McDanel

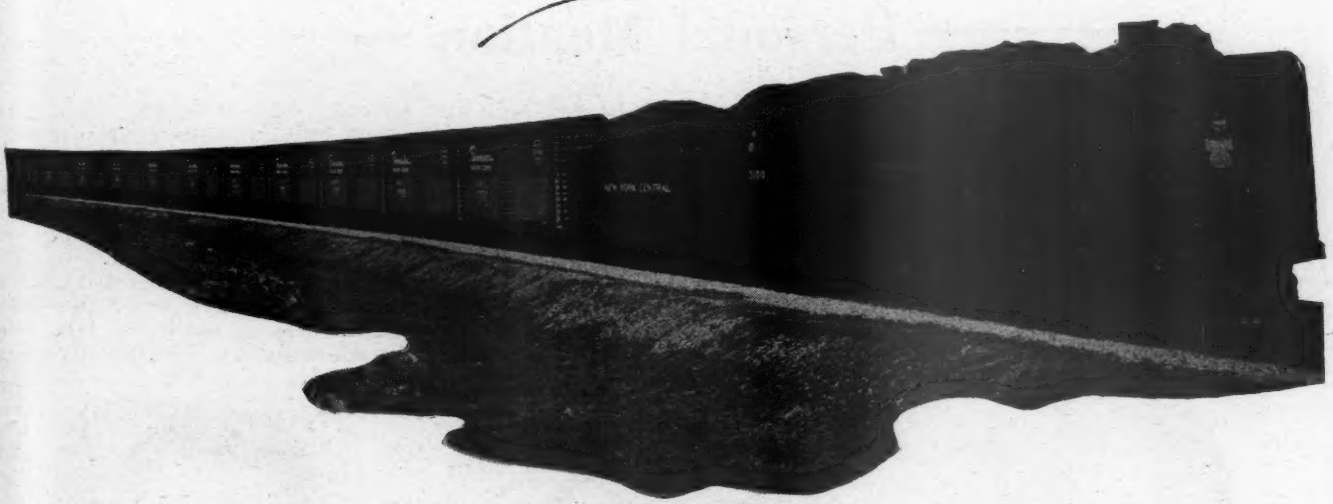


Frank K. McDanel

was appointed general superintendent of the shops in 1923, in which capacity he supervised the fabrication of steel for the Empire State Building, the San Francisco-Oakland Bay bridge, Radio City and many other skyscrapers and bridges. Elected vice-president and a director of American Bridge six years ago, he was in charge of the company's manufacturing operations during the war.

NEW YORK CENTRAL'S

NEW *Pacemaker* FREIGHT TRAIN



SPEEDED BY 4-8-2 LIMA No. 3100

To maintain a ten-hour schedule between New York and Buffalo for its new Pacemaker fast freight service, beginning July 1, the New York Central will employ modern steam motive power.

Leaving New York at 7:15 P.M. E.S.T. and including stops at Albany, Utica, Syracuse and Rochester, to deliver and pick up cars, the west-bound Pacemaker will arrive at Buffalo at 5:15 A.M. This necessitates a road speed up to 65 miles an hour with trains of up to 75 cars. The east-bound Pacemaker has a similarly fast overnight schedule.

For this outstanding service to shippers, the New York Central has provided 1000 specially designed box cars; the upper halves and doors painted vermillion and the lower halves dark gray. The illustration shows the Pacemaker freight train powered by Lima-built No. 3100.

LIMA LOCOMOTIVE WORKS — LIMA LOCOMOTIVE WORKS INCORPORATED — INCORPORATED, LIMA, OHIO

American Chain & Cable Company.—*A. P. Hall* has been elected vice-president of the American Chain & Cable Company, Inc. Mr. Hall will continue as general manager of sales, and his headquarters will remain at 230 Park avenue, New York.

◆

Metallizing Company of America.—The Metallizing Company of America have moved their eastern office and warehouse to 431 East Seventy-fifth street, New York 21.

◆

Brown Boveri Corporation. — The Brown Boveri Corporation, 19 Rector street, New York, hos been incorporated under the laws of the State of New York as an affiliate of Brown, Boveri & Co., Ltd., of Baden, Switzerland. The new company, devoted to an expansion of the activities carried on by *Paul R. Sidler* at New York for nearly 15 years, will intensify the dissemination of data and information on new Brown Boveri products and their application. Mr. Sidler is president of the new corporation.

◆

Independent Pneumatic Tool Company.—*Walter G. Mitchell*, chief production engineer of the Independent Pneumatic Tool Company, Chicago, has been appointed director of engineering and research.

◆

Drico Industrial Corporation. — Dri-Steam Products, Inc., has changed its name to the Drico Industrial Corporation. The address, 29 Broadway, New York 6, is unchanged.

◆

Parker Appliance Company.—*Dan W. Holmes*, formerly with the Weatherhead Company, has been appointed general sales manager of the Parker Appliance Company, to succeed *Fred E. Amon*, who has become manager of aircraft sales.

◆

H. K. Porter Company.—The H. K. Porter Company has announced the removal of its Boston, Mass., office to 294 Washington street, Room 735, Boston 8.

◆

New York Belting & Packing Co.—The New York Belting & Packing Co., of Passaic, N. J., is celebrating its 100th anniversary this year.

◆

Turco Products, Inc. — *Thomas G. Fransreb* and *Donald Keating* have been appointed to the technical service division of Turco Products, Inc.

Obituary

William James George, assistant to the president of the Edgewater Steel Company, died on June 17. Mr. George was 53 years old. He was born in Lonaconing, Md., and attended the Carnegie Institute of Technology. He had been with Edgewater Steel since the company's organization in 1916.

Personal Mention

General

Alfred G. Hoppe, who has been appointed general superintendent of the locomotive and car departments of the Chicago, Milwaukee, St. Paul & Pacific, at Milwaukee, Wis., as announced in the July issue, was born at Milwaukee on May 9, 1895, and is a graduate of the University of Wisconsin. He entered railway service on October 15, 1919, as a mechanical draftsman at Milwaukee, and one year later was assigned to the test department where he became engineer of tests in December, 1927. In March, 1936, Mr. Hoppe was appointed assistant mechanical engineer; in 1942, assistant to the mechanical assistant to the chief operating officer, and in December, 1944, assistant chief mechanical officer.

Alfred G. Hoppe

John O. Green, who has been appointed superintendent of motive power and car equipment of the Gulf, Mobile & Ohio, with headquarters at Mobile, Ala., as announced in the July issue, was born at Englewood, N. J., on January 12, 1893. He received his higher education at Cornell University, and after being employed with the Erie City Iron Works, Erie, Pa., and the General Electric Company, he served for more than 20 months overseas with the A. E. F., as an aviation pilot during World War I. He entered railway service in October, 1922, as mechanical engineer of the Gulf, Mobile & Northern (now the Gulf, Mobile & Ohio) with headquarters at Mobile. In 1927 Mr. Green became master mechanic of the Mississippi Central at Hattiesburg, Miss., and in 1937 returned to the G. M. & O., as shop superintendent at Mobile. In 1941 he became master mechanic at Mobile.

John O. Green

L. S. Crane, assistant chief material inspector of the Southern at Alexandria, Va., has been appointed assistant engineer of tests at Alexandria.

Fayette Thomas, who has been appointed assistant to the general superintendent of motive power of the New York Central System at New York as announced in the June issue, was born on October 20, 1898, at Cary, Ill. He entered the employ of the Michigan Central on May 12, 1920, as an electrician at Chicago. On July 1, 1922, he became foreman of electricians at Chicago and on October 1, 1926, foreman of electricians at Niles, Mich. He became chief electrician of the Indiana Harbor Belt on July 16, 1940, and supervisor of electric operation and Diesel locomotives for the Indiana Harbor Belt, and Chicago River & Indiana, and the Chicago Junction Railway, on January 1, 1943. He returned to the New York Central System on February 16, 1944, as supervisor of Diesel locomotive maintenance, with headquarters at New York, and on May 1, 1946, was appointed assistant to the general superintendent of motive power, in charge of Diesel operation and shops.

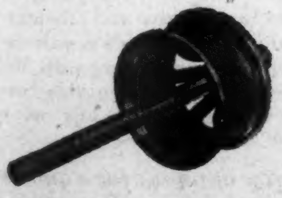
Fayette Thomas

Dean F. Willey, assistant general manager in charge of engineering, maintenance and mechanical departments of the New York, New Haven & Hartford at New Haven, Conn., has been appointed assistant vice-president in charge of operation, maintenance and engineering at New Haven. Mr. Willey was born at Manchester, N.

Constantly Increasing Speed of Operation

means that to meet faster schedules, *train tonnage must be reduced.*

OR – to maintain those schedules with the same train load, *locomotive horsepower must be increased.*



THE FRANKLIN SYSTEM of STEAM DISTRIBUTION

will provide additional horsepower at the higher speed.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

H., on August 5, 1896, and is a graduate of the Massachusetts Institute of Technology (1920). He entered the employ of the New Haven in June, 1920, as assistant engineer, department of tests, and in April,

Dean F. Willey

1923, was appointed general material supervisor. In October of 1923 he became mechanical inspector and the following month was appointed foreman mechanical inspector at Boston, Mass. He became acting general foreman in July, 1924; general foreman on November 1, 1924, and assistant to superintendent of shops at Readville, Mass., in September, 1925. On May 16, 1930, he returned to New Haven as special mechanical assistant. He was appointed mechanical superintendent in January, 1937; general mechanical superintendent in May, 1941, and assistant general manager in charge of engineering, maintenance and mechanical departments in November, 1944.

R. B. Hunt, superintendent motive power and machinery of the Florida East Coast, has been appointed chief mechanical officer, with headquarters as before at St. Augustine, Fla. The office of superintendent motive power and machinery has been abolished.

Car Department

Oscar N. Schoppert, whose retirement as master car builder of the Western Maryland at Hagerstown, Md., was announced in the July issue of *Railway Mechanical Engineer*, was born on May 22, 1881, at Piedmont, W. Va. He entered railroading in 1901 as a car repairman in the employ of the Western Maryland at Ridgeley, W. Va. He became a clerk in 1912; chief clerk to master car builder in 1914; traveling car inspector in 1921, and assistant to master car builder at Cumberland, Md., in 1923. Mr. Schoppert then became general car foreman at Cumberland, and in 1935 was appointed master car builder.

William E. Corr, whose retirement as superintendent of car department of the Seaboard Air Line, at Norfolk, Va., was announced in the July issue, was born at Gloucester, Va., on April 15, 1891, and began his railroad career as a timekeeper for the Seaboard Air Line in 1912. He subsequently served successively as piecework checker, statistician, equipment in-

We Gladly Shoulder Our Share Of This Load

TO build into your General Motors Diesel locomotives all the quality and performance that Electro-Motive research, experiment and experience have made possible is only the beginning of our responsibility to you. Our next is to do everything within our power to help you keep them running at peak performance.

Now, with the completion of the new Service Building at La Grange — with additional instructors, classroom facilities and equipment, the Electro-Motive Diesel Locomotive School is in a better position than ever to aid in training the supervisory personnel of our customer-railroads.

This is, of course, in addition to the services offered by our Instruction Car which travels on American railroads giving maintenance and operation courses to all classes of personnel.

We cannot too emphatically stress the value of the instruction given in a two-weeks' course at the School, especially in the development of lower maintenance and operating costs.

For detailed information, including day-by-day outline of the program, write Mr. D. H. Queeney, Service Manager, Electro-Motive Division, General Motors, La Grange, Ill.

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS — LA GRANGE, ILL.

spector, assistant car foreman, foreman, general foreman, assistant master car builder, and master car builder. He was appointed superintendent of the car department at Norfolk in 1930.

L. R. RAETHER, chief electrical and Diesel supervisor on the New York Central at Detroit, Mich., has been appointed superintendent of Diesel shop at Niles, Mich.

F. G. LOWE has been appointed rule and mechanical instructor of the Northern Ontario district of the Canadian National, with headquarters at North Bay, Ont.

Master Mechanics and Road Foremen

J. A. PETERS, assistant master mechanic of the Southern Pacific, at Tucson, Ariz., has been appointed master mechanic at Tucson.

F. W. KUBLER, master mechanic of the Southern Pacific, at Los Angeles, Calif., has been transferred to the position of master mechanic at San Diego, Calif.

N. L. MCCRACKEN, master mechanic of the Southern Pacific, at Tucson, Ariz., has been transferred to the position of master mechanic at Los Angeles, Calif.

T. F. O'CONNELL, assistant master mechanic of the Southern Pacific at San Diego, Calif., has retired.

Electrical

R. H. HARRISON has been appointed assistant electrical supervisor of the Western Maryland with headquarters at Hagerstown, Md.

Shop and Enginehouse

K. D. READ, assistant superintendent of shops on the New York Central, at West Albany, N. Y., has been appointed superintendent of shop, locomotive department, at Beech Grove, Ind.

M. W. MCMAHON, assistant to general superintendent of motive power on the New York Central, at New York, has been appointed assistant superintendent of shop, locomotive department, at Beech Grove, Ind.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

CARBIDE-STEEL MILLING MACHINES.—Kearney & Trecker Corporation, Milwaukee 14, Wis. A 24-page catalogue CSM-20, printed in color, descriptive of 20-, 30- and 50-hp. CSM knee-type milling machines, in horizontal and vertical models.

◆

MUREX.—Metal & Thermit Corporation, 120 Broadway, New York 5. Sixteen-page illustrated bulletin describes the Type HTS lime-ferritic electrode designed to prevent

underbead cracking in the welding of "difficult-to-weld" steels. Tables give full data on physical properties and chemical analysis of the Type HTS deposit in all standard electrode sizes. Various actual applications are discussed.

◆

IDEAL MACHINERY PRODUCTS.—Ideal Industries, Inc., 1296 Park avenue, Sycamore, Ill. Etchers; Air Horse products—a pneumatic drill, a pneumatic screw driver and nut setter, a rotary file and die grinder, and a pneumatic riveting hammer; pneumatic tool accessories; a new dust collector; chucks, and grinding-wheel dressers are among the Ideal products described and illustrated in this company's 24-page catalogue, Form MTC-1245.

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SMALL TOOLS — George F. Marchant Company, Chicago. Catalogue No. 46 describes the punches, dies, couplings, rivet sets and other tools made. Over 200 sketches with full dimensional details illustrate the various types of tools.

Miscellaneous Publications

"THE APPLICATION OF SILICONE RESINS TO INSULATION FOR ELECTRIC MACHINERY." — Dow Corning Corporation, Midland, Mich. Copies of the paper, "The Application of Silicone Resins to Insulation for Electric Machinery" by J. DeKiep, L. R. Hill and G. L. Moses, which won the annual A. I. E. E. award for excellence, have been made available by the Dow Corning Corporation. This paper describes the application of silicone resins including laboratory tests on materials and coils as well as tests on rotating apparatus, and discusses practical problems involved in the use of these materials to obtain adequate high-temperature insulation. Thermal aging tests are also reported and recommendations are made covering tentative temperature limits for general rating and application purposes.

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WESTINGHOUSE ELECTRIC CORPORATION.—Designed to give in a clear, concise manner a fundamental knowledge of the construction, operation and selection of electrical measuring instruments, an intensive course including sound slide films, a complete pocket-size textbook, and an instructor's manual, has been prepared by the Westinghouse Electric Corporation. Primarily for use by the Westinghouse organization, the course has also been made available to educational institutions, engineering societies, and the engineering departments of all organizations that use electrical measuring instruments. Cost of a complete course, based on a class of twenty members, is $45. Distribution will be handled by the Industrial Relations Department, Westinghouse Electric Corporation, 306 Fourth avenue, Pittsburgh 30, Pa. Subjects covered in films and lessons are: Importance of Electrical Instruments; The Permanent Magnet Moving Coil Mechanism; The Electro-Dynamometer Mechanism; The Stationary Coil and Moving Iron Mechanism; The Rotating Vane Mechanism; The Selection and Use of Electrical Instruments. It is recommended that the course be given in six one-hour sessions, with each session covering one lesson. The Instructor's Manual, suggests classroom procedures and contains essential reference material.